American Machinist

OCTOBER 6, 1949

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Welding a power shovel underframe — see page 2

• COST CUTTING CLINIC

Here's How the Heald

UNIVERSAL FIXTURE

can speed up your small-lot borizing

- **Ideal for handling a wide variety of work**
- **Permits fast, easy setups**
- **Cuts changeover time**

Where a Heald Bore-Matic is called upon to handle many different pieces of work, with short to medium-length runs, a specially designed fixture for each piece would be impractical. You can get essentially the same results, however, with the Heald Universal Type Fixture, designed for use with Model 321 and Model 221 Bore-Matics.

This versatile work-holding device is provided with a cross slide and vertical slide which are operated manually at right angles to each other, permitting precision alignment of any part, quickly and easily. It can be supplied with practically any desired type of face plate, for either fixed or rotary indexing. This fixture will give your Bore-Matic extra versatility and ease of setup, with minimum down time for frequent changeovers. The gage blocks shown below in the rack on the machine table aid in the accuracy of these changeovers.

Your nearest Heald representative will be glad to give you the complete story on this precision-built Universal Type Fixture—as well as the precision Heald Bore-Matics with which it can be supplied.

HEALD

PRECISION INTERNAL AND SURFACE GRINDERS

PRECISION BORE-MATIC FINISHING MACHINES

THE HEALD MACHINE COMPANY

Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit
Indianapolis • Lansing • New York

64 DIFFERENT SIZES OF VALVE BODIES, as well as a score of other miscellaneous parts, are handled by this Heald Universal Type Fixture, installed on a Model 321 Bore-Matic.

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Our Cover . . . Welding the lower frame for a 6-cu yd power shovel crane in a plant of Lukenweld, division of Lukens Steel Company, Coatesville, Pa. This frame is of all-welded construction, utilizing A-285 Grade "C" flange-quality steel. The third welder is just visible in the smoke at top.

The table on the weldment positioner rotates 360°, and is adjustable for five positions, 0, 35°, 45°, 55° and 90°. The 22-ton positioner is portable, has an 18 x 32-ft base and can handle 23 tons with a center of gravity 5 ft off the table with the table vertical. The 17-ft dia table is motor driven and may be remote-controlled to rotate at rim speeds of 7 to 42 in. per min.

Metal Show . . . As usual, this issue carries a preview of the Metal Show in Cleveland, Oct. 17-21. We have a list of exhibitors, papers, and descriptions of equipment to be shown for the first time there. We will report the Show and accompanying technical sessions in our issue of Nov. 3.

Cost Sleuthing . . . Some six months ago, we began digging through back issues of *A.M.* for cost-cutting ideas, with the intention of publishing a report in September. Then we decided to add data directly from industry and wrote to several hundred manufacturers. Their replies, our previously published pointers and our own editors' ideas are combined in our current "Cost Cutting Clinic." Assistant Editor Stocker did most of the organizing, delving and planning, with assists from Managing Editor Tangerman and Associate Editors LeGrand and Linsley . . . It is a guide only; detailed cost-cutting suggestions appear in every issue, would be much too voluminous to compress into this space. But you'll find hundreds of ideas here, subdivided by subject.

Tooling . . . We've managed to squeeze in four tooling features, one on air fixtures, another on a special hone and the third a spread of Talented Tooling pictures. Also included is the first of two articles on multiple-thread hobs, by Breuer of Barber-Colman (biog. below) a recognized authority.

Not Enough Psi . . . Remember that cover (Aug. 25 *A.M.*) showing the big boring mill working on a steam-turbine casting? We said, on this page, that the unit would operate at 450 psig. Allis-Chalmers hastens to point out that it should be 1,450—which, while not the highest operating pressure yet attained, is right up there . . . Our steam man was on vacation when it went through, and adds to our confusion by laughing over the coincidence of a picture showing a big hole being bored and a cover title showing one of the features, "Drilling Tiny Holes." When the gods laugh at us, they laugh all over.

Small Orders . . . Small orders can be a cost bugaboo. Charles D. Hoyt, Jr., president of the National Screw Machine Products Assn., and chairman of its committee on statistics, traces a path through the maze.

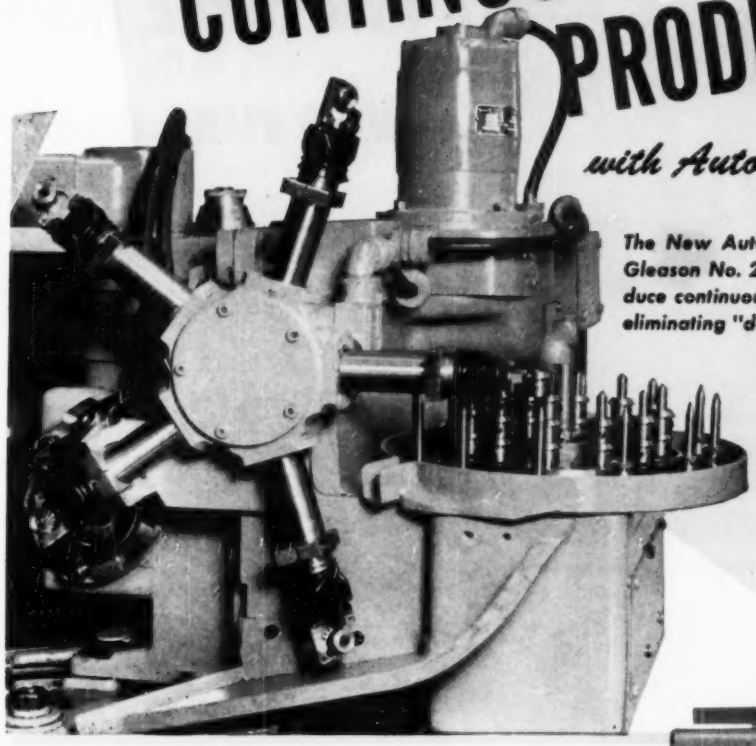
Remember When? . . . Back in 1877, steel engravings were advertised in *A.M.* as the "new process." In 1879, George P. Clark of Windsor Locks, Conn., advertised newly invented rubber casters thuswise: "No more noise. Save your carpets. Also one of the best non-conductors for Rheumatism." Remember when rheumatism was thought to result from the electricity in the ground?

Coming . . . *A.M.* for Oct. 20 will include a Special Report on Modern Gear Cutting Machines, prepared during the past year by Charles Pfeffer, gear consultant. There'll also be articles on Buick heat-treating, positive knockouts for dies, use of light gages for tapers, a back-sliding cutter, standardization of die costs, and the conclusion of Mr. Breuer's series on multiple-thread hobs . . . And remember, Nov. 3 *A.M.* is our Mid-Century Inventory Number, a record of America's present resources in metalworking equipment.

HUNTER OF "TENTHS" . . . **John P. Breuer is the gear and hob engineer sent out by Barber-Colman Company when a customer is searching for the last 0.0002 in. in gear-cutting accuracy. Mr. Breuer has been associated with Barber-Colman since 1911, and he has acquired an intimate knowledge of design, production and inspection problems relating to hobs or gears. His latest article, on multiple-thread hobs, appears in this issue. He is a member of numerous technical committees, including the Technical Committee on Standardization of Splines and Spline Shafts, Subcommittee on Involute Splines, Fine-Pitch, Subcommittee and Sectional Committee on Roller Chains, Sprockets and Cutters, ASME, as well as the Fine-Pitch Gearing Committee, Gear Cutting Tools Committee and Splines Committee, AGMA.**

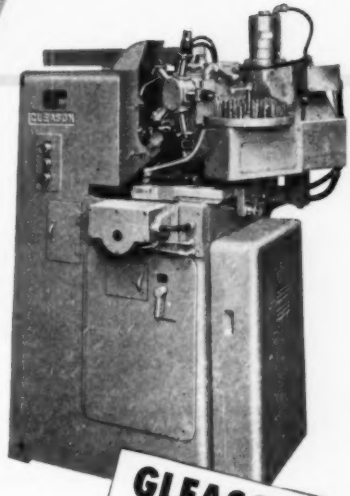
CONTINUOUS PRODUCTION

with Automatic Loading



The New Automatic loader enables the Gleason No. 2 Hypoid generator to produce continuously without stopping—thus eliminating "down time" on the machine.

The Gleason No. 2 Hypoid Generator is a versatile generator, providing close control of actual cutting at faster times than previously possible. This machine produces spiral bevel, Zerol bevel and hypoid gears and curvic clutches in the small sizes (16 D.P. and finer) with a superior tooth bearing. Whether it is used for jobbing or production, the No. 2 Hypoid Generator is ideally suited for the production of bevel and hypoid gears for small tools and appliances.



GLEASON
Works
1000 University Avenue
Rochester 3, N.Y., U.S.A.

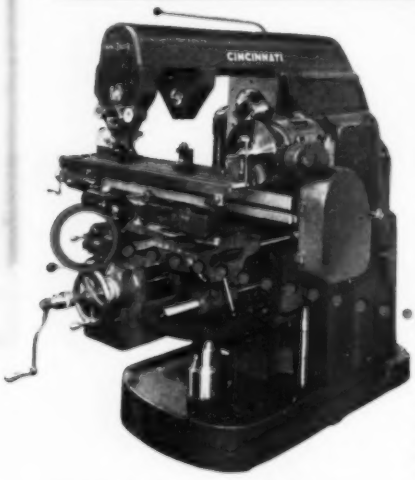
Builders of Bevel Gear Machinery for Over Eighty Years

Talk to the man who runs one!

The man at the machine has more influence on performance than you might think. Take the simple chore of changing speeds and feeds, for example. From start to finish of some jobs, this can (or should) happen several times for each part. Make it easy to do, and the operator will have no objection to doing it. Make it difficult or out of reach, and efficient cutting practice usually fares badly. ¶ Recognizing the operator's influence on shop costs, Cincinnati has incorporated two big features of easy operation in all their Dial Type Milling Machines.

1. Power selection and changing a wide range of spindle speeds
2. Power selection and changing a wide range of feeds

Talk to the man who runs a Dial Type. He'll tell you that Dial Type ease of operation is tops with him. And that makes them tops in reducing the cost of milling operations.



CINCINNATI Dial Type Milling Machines have labor-aiding power speed and feed change front and rear. Built in Nos. 2, 3 and 4 sizes; medium and high speed ranges; plain, universal and vertical styles. Catalog M-1623-1.

With one hand, and without walking or stretching, the entire range of Dial Type speeds and feeds can be changed with this lever. It's as easy as turning a radio dial and is duplicated at the rear.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

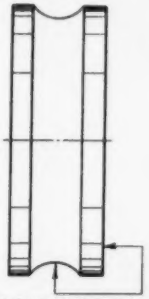
MICRO-CENTRIC GRINDING

Cuts Cost of Perfection

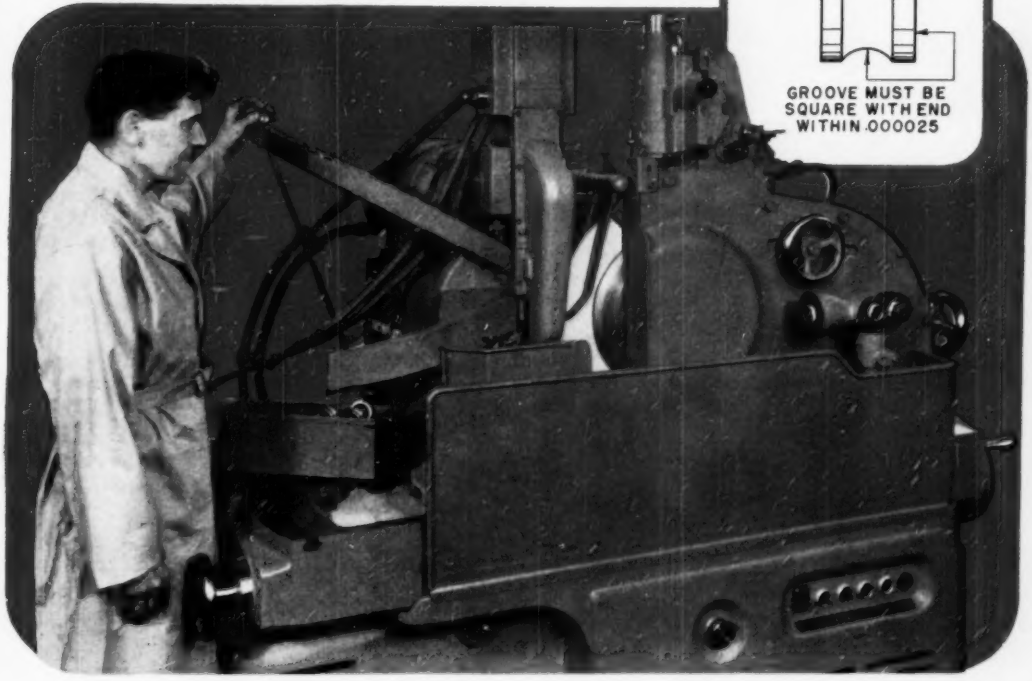
To a New Low!

Micro-Centric grinding the diameter of bearing races square with one end, at a production of approximately 165 per hour. The machine is a CINCINNATI FILMATIC No. 1 Micro-Centric Grinder, equipped with an automatic loading attachment. Complete information may be obtained by writing for catalog No. G-573.

The tolerances indicated here may be specified and obtained on Micro-Centric ground parts.



GROOVE MUST BE SQUARE WITH END WITHIN .000025



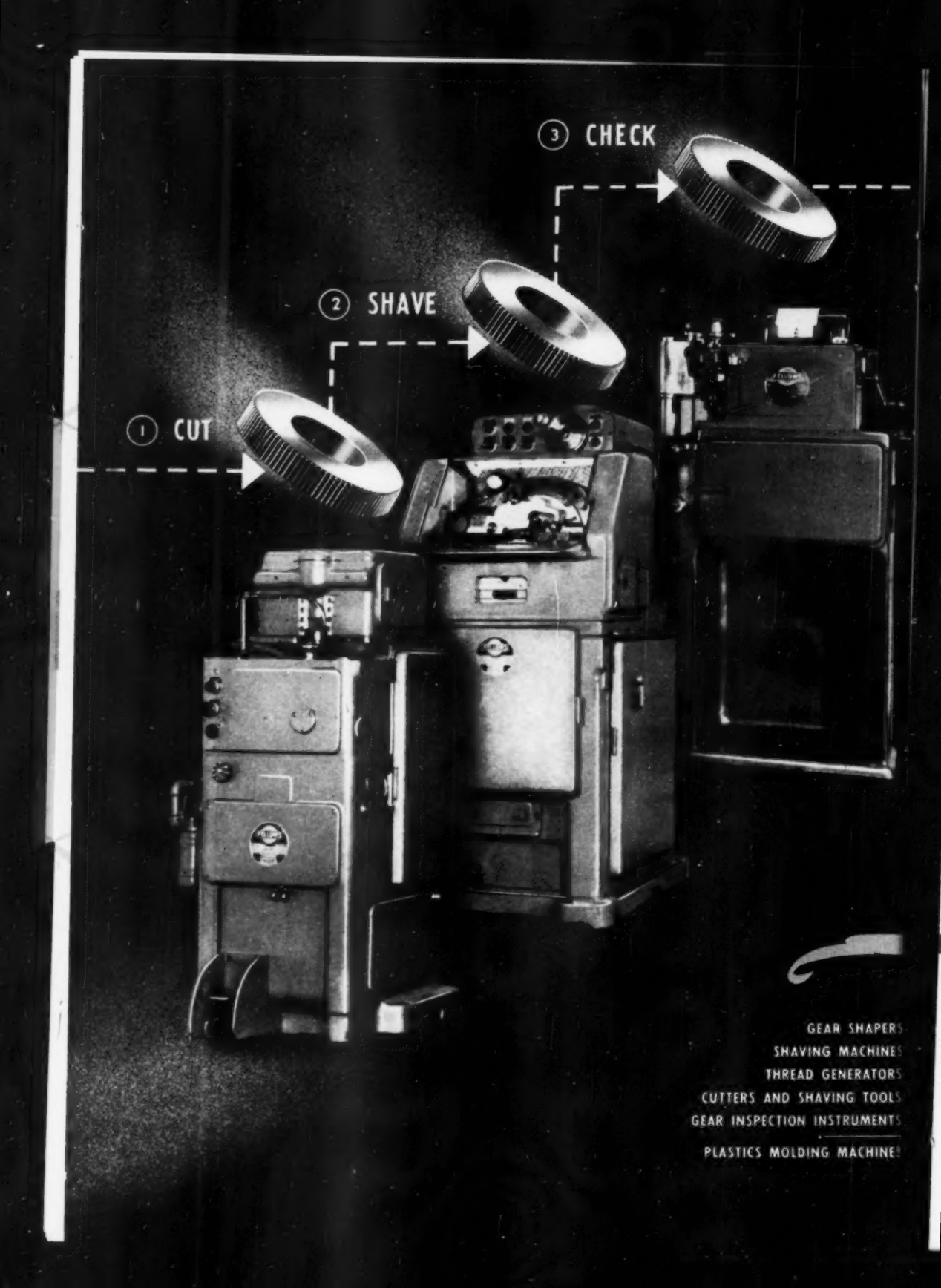
Perfect accuracy can now be approached by a new method of grinding incorporated in CINCINNATI FILMATIC Micro-Centric Grinding Machines. **Round within .000025", and square with one prefinished end within .000025"!** This high degree of near perfection, obtained by grinding, is made possible by Micro-Centric's new method of work support and rotation. ¶ Short parts such as bearing races can now be Micro-Centric ground at **costs as low as one fourth the former method.** Two sizes of these machines are available: No. 1, capacity ¾" to 3½" diam.; No. 2, capacity 2" to 8" diam. Our Application Engineers will be glad to tell you how CINCINNATI FILMATIC Micro-Centric Grinders can be applied to your work. Write for catalog G-573.

CINCINNATI

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS LAPPING MACHINES • CENTERLESS GRINDING MACHINES



GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

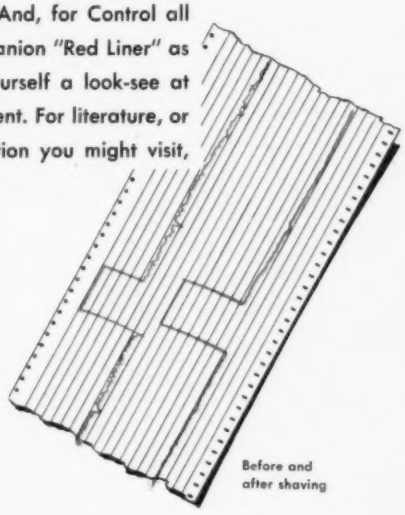
How to Make SMALL GEARS *Good* ...AND FAST!

Quality is a matter of tooth form and overall gear accuracy for which the Fellows method has always set the highest production standards.... **Speed**, too, finds Fellows in a leadership position. With cutter speeds up to 3,000 strokes per minute, the 3-inch Fine-Pitch Gear Shaper is in a class by itself. With Magazine Loading, small gears and pinions are cut at phenomenal rates....Where Shaving is required the No. 4 Fine-Pitch Gear Shaving Machine balances out as an effective running mate. And, for Control all along the line there's the companion "Red Liner" as illustrated here....You owe yourself a look-see at the latest in cost saving equipment. For literature, or reference to a nearby installation you might visit, write the nearest Fellows office.

1. Fellows Fine-Pitch Gear Shaper for gears from 1/16 in. to 3 inches pitch diameter. Thin blanks can be ganged to ¾ inch total face width. Magazine feed for small pinions. Cuts spur and helical, external and internal gears.

2. Fellows No. 4 Fine-Pitch Gear Shaving Machine for high-speed finishing of small spur or helical gears. Electrical control for automatic time cycling.

3. Fellows "Red Liner" for charted inspection records of all errors in combination, with inaccuracies magnified 200 times. Chart analysis identifies and measures different errors.

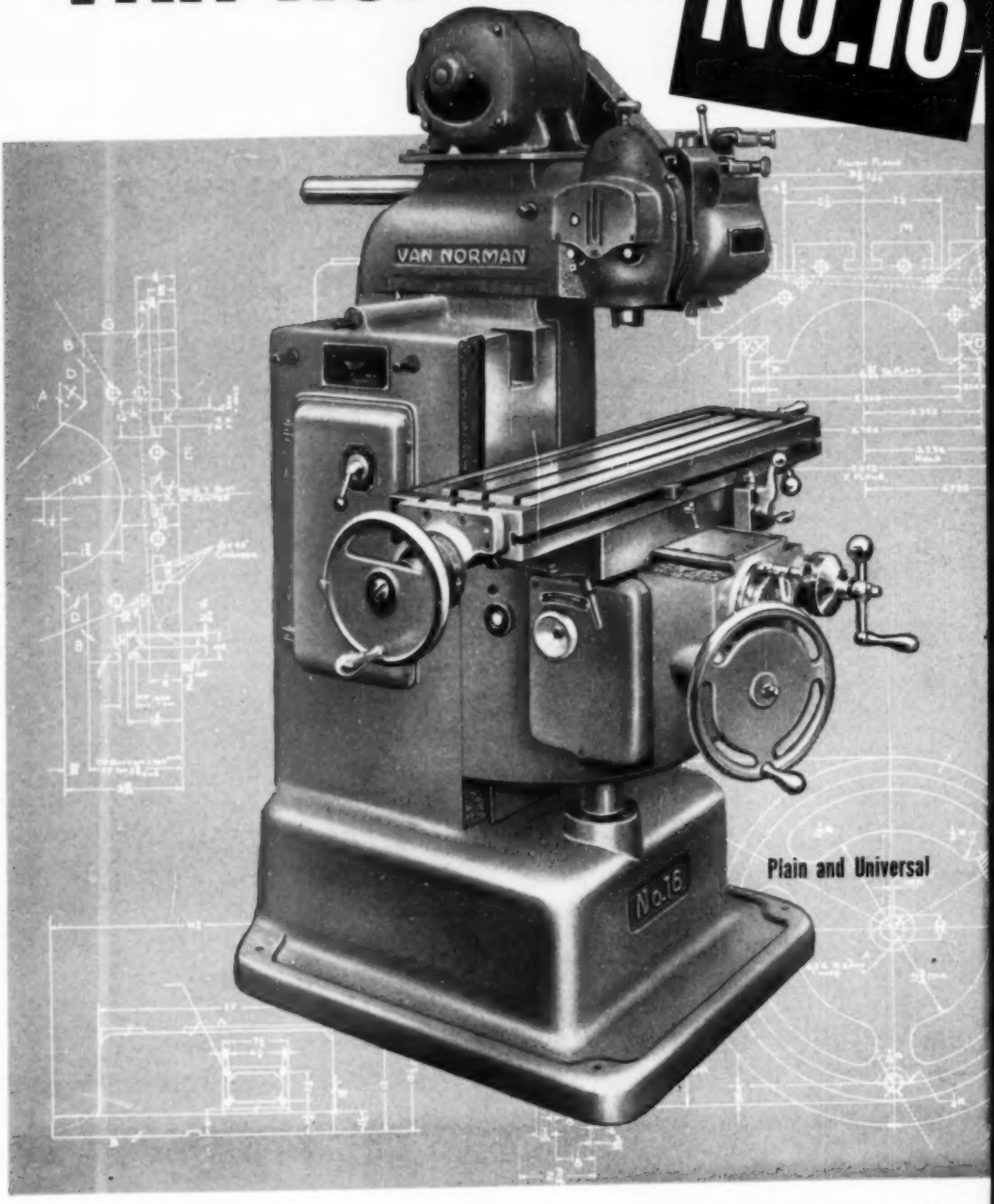


Before and after shaving

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont.
Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 7706 Empire State Bldg., New York 1.

VAN NORMAN No. 16



Plain and Universal

RAM TYPE MILLER

Gives You Increased Work Range... Saves Time...Reduces Costs

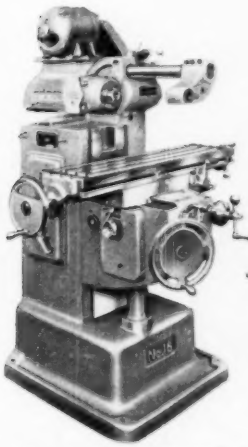
Among the outstanding features of this miller are the adjustable swivel cutterhead and movable ram. The combined adjustments of cutterhead and ram movement permit conventional horizontal, vertical as well as angular milling on one machine. Because most jobs can be carried through to completion without change in set-ups, the savings in set-up time alone are substantial enough to quickly pay for this miller. Not only does the No. 16 reduce work reset-ups but it also eliminates idle machine and operator time by as much as 50% since there is no waiting for single purpose machines . . . no moving of work from one type of miller to another. With the Van Norman Ram Type Miller, most non-productive time is eliminated as the operator usually moves the adjustable cutterhead instead of the work-piece.

Check These Van Norman Additional Features — Built-in single lever operating control. . . movable ram scale . . . spindle speeds up to 2000 RPM . . . wide feed range . . . increased work range . . . easy-to-read dials . . . large hand wheels . . . hardened alloy-steel gears . . . heavy, internally ribbed column and base . . . compact, rigid, powerful . . . smooth and accurate performance.

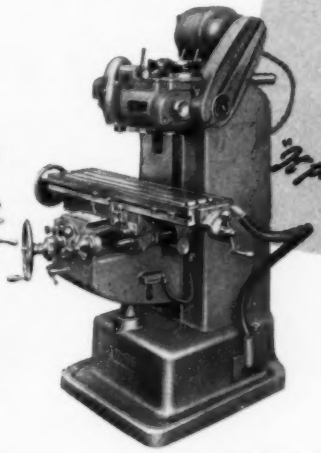
Investigate the Van Norman No. 16 Miller, today. Write for bulletin.

Van Norman COMPANY
Springfield 7, Massachusetts

"It pays to Van Normanize"



No. 16 Miller with adjustable cutterhead in horizontal position.



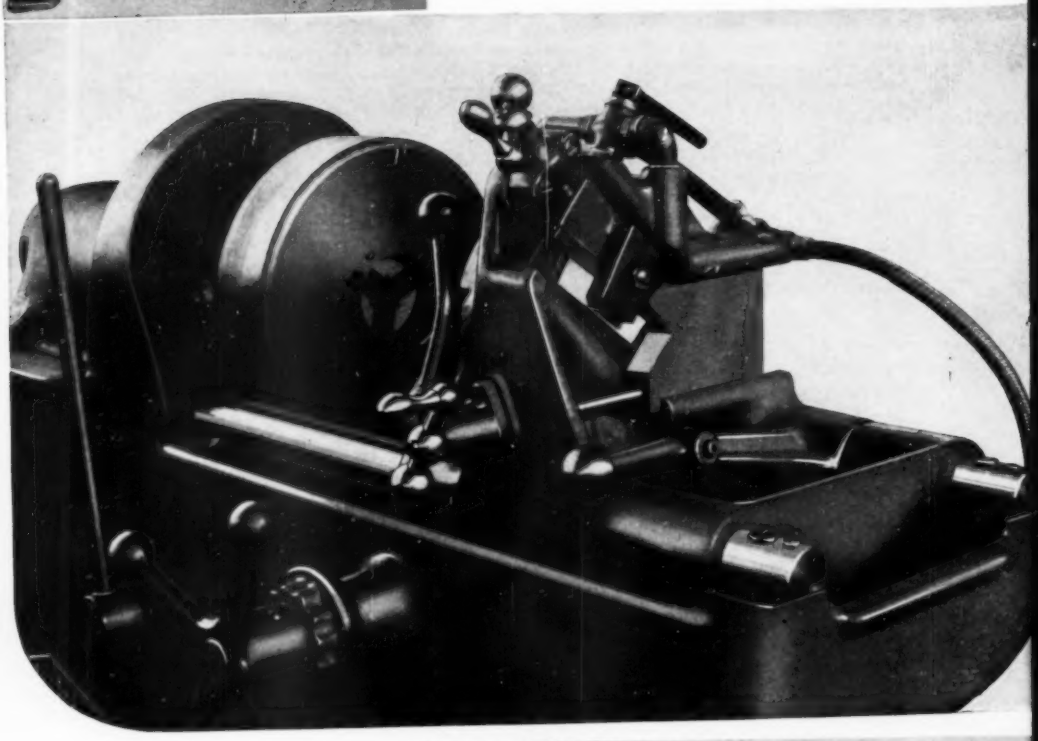
Adjustable cutterhead in vertical milling position.

The LITTLE LANDIS

For **MAINTENANCE**

and

JOBBING



LANDIS
REG. U.S. TRADE — MARK PAT. OFF.

LANDIS

Pipe Threading & Cutting Machine

• The LITTLE LANDIS Pipe Threading and Cutting Machine is designed for threading bolts and for cutting off and threading pipe in jobbing and maintenance shops. In the illustrations on this page, the 2" LITTLE LANDIS is producing bolt threads for use in maintenance work.

The LITTLE LANDIS can handle a variety of work at a minimum cost, permit the quickest possible set-up changes, and produce cleanly-cut and well-formed threads on all materials. It uses the Landis Chaser, the only pipe threading die with the same free-cutting action and natural clearance of a lathe tool. This allows for long life between chaser grindings and smooth finish and accuracy in the finished thread.

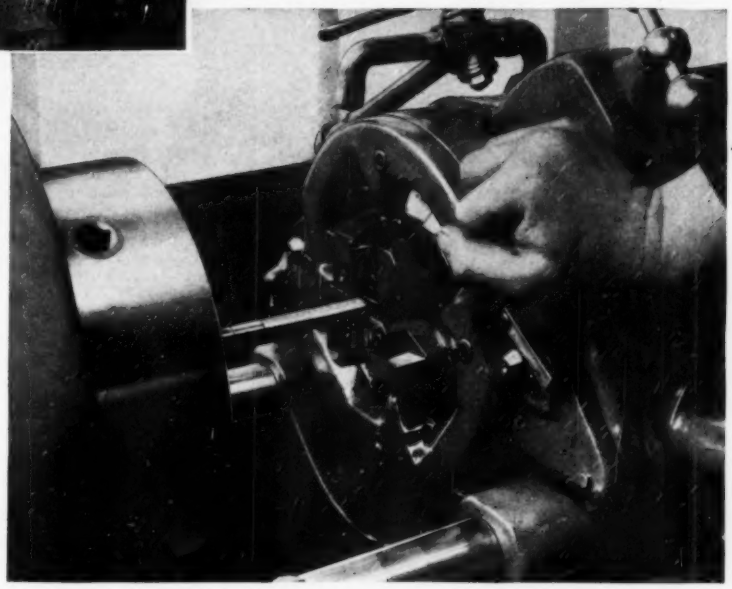
Write for Bulletin C-82

FOR QUICK SET-UP CHANGES...

The ¾" and 2" Landis Stationary Die Heads, standard equipment with the LITTLE LANDIS, give rapid flexibility in cutting pipe threads within a range of ¼" to 2" and bolt threads ¼" to 1¼" or ⅜" to 1½".

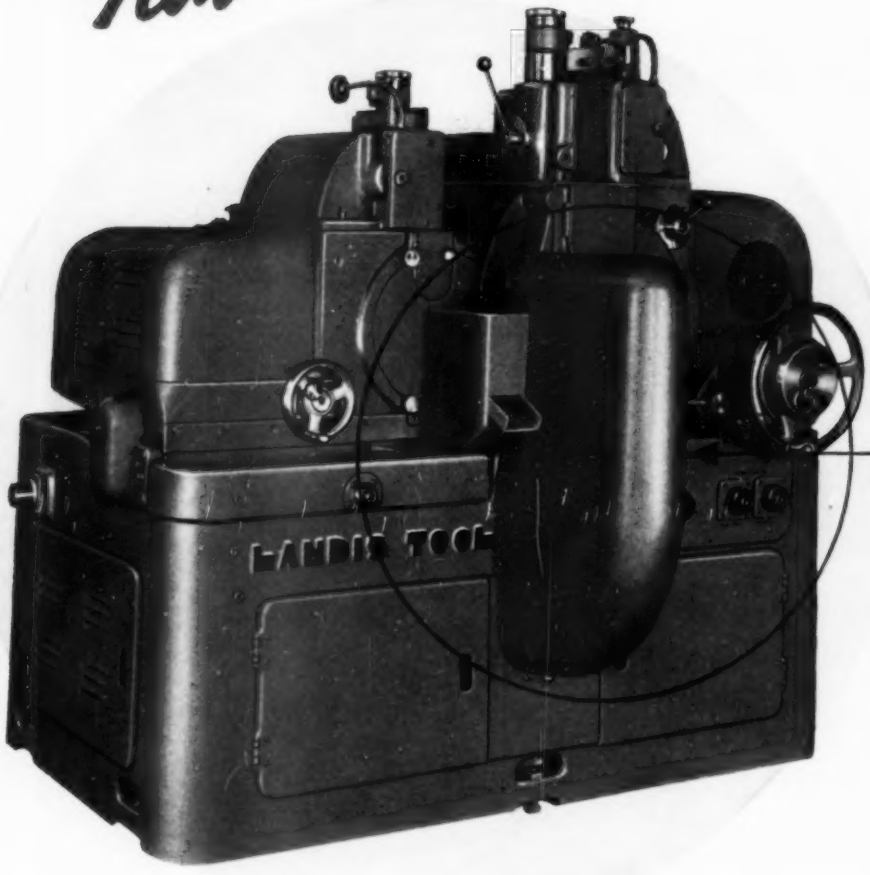
The die heads are supported on the cross rail and locked securely in position by a latch. They are readily interchanged in a few seconds.

The Stationary Die Heads are quick-opening, with opening and closing controlled through a lever on the side of the head. Size adjustment is universal, made through a self-locking hand-wheel.



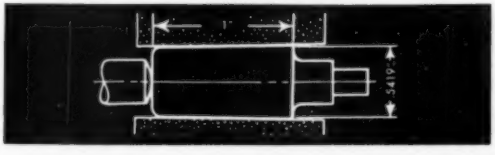
MACHINE CO. WAYNESBORO PENNA. U.S.A.

New! timed cycle loader



600 PER HOUR TAPERED ROLLER
5 micro inch finish
.001" stock removal
.00025" tolerance

here are actual production figures



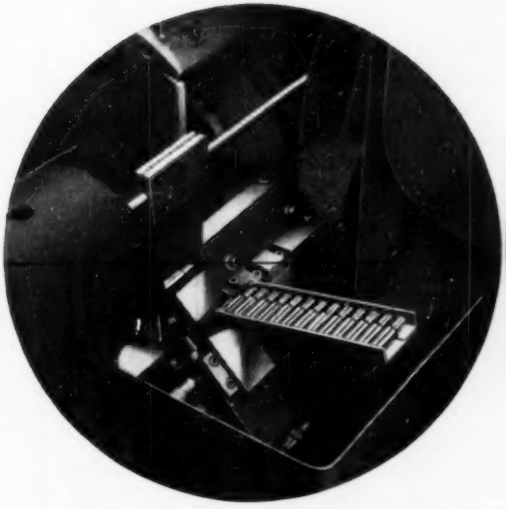
LANDIS TOOL
Precision Grinders

109

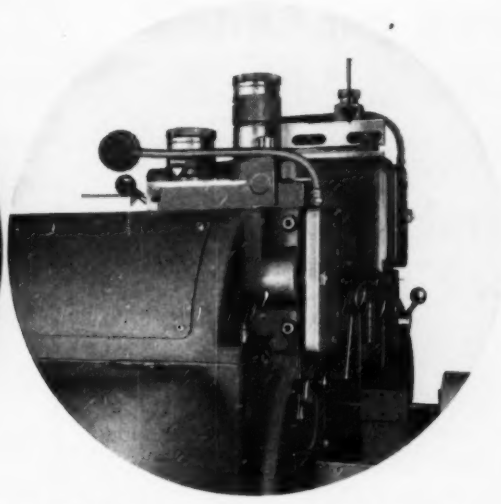
for centerless infeed grinding

now available on LANDIS TOOL centerless grinders

● **loader moves work between the wheels and ejects after grinding.**



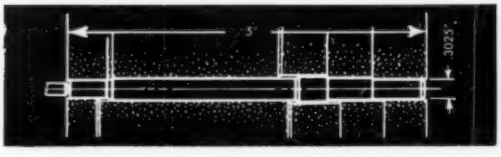
Work loaded from side for infeed grinding of 3 diameters. Both grinding and regulating wheels are profile dressed.



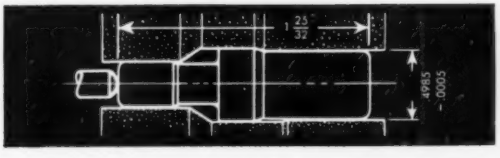
Profile bars on grinding wheel and regulating wheel dressers. Note how the simple design permits quick changeover on new job set-ups.

If you have a precision grinding problem, production estimates and tooling suggestions will be made on the basis of your blueprints.

300 PER HOUR SHAFT—4 DIAMETERS, 1 TAPER
.0005" limits on diameter
.012" stock removal



370 PER HOUR 3 DIAMETERS
.008" stock removal
.0005" tolerance

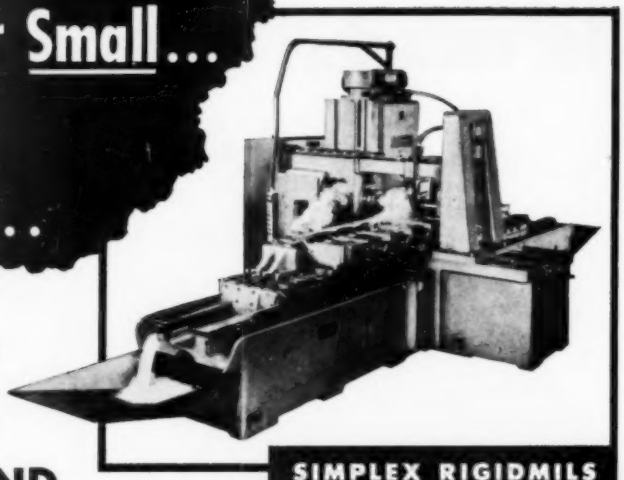


LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

For Big Jobs or Small... Simple or Complicated...

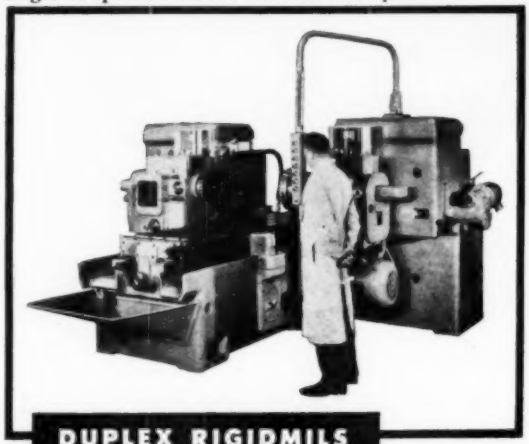
You'll get better Milling Methods with SUNDSTRAND "Engineered Production" and Equipment

Here are some representative examples of machine tools, equipment and services offered by the Machine Tool Division of Sundstrand. Standard basic machine designs and units, coupled with methods engineering assistance, has resulted in many cost-saving Sundstrand installations. In addition to the basic standard unit type machine designs, you will find various attachments and accessories to speed up operations. All have been time-tested and proven in past performance. If you have metalworking operations in your plant and are interested in lowering manufacturing costs, call in a Sundstrand representative. He'll be glad to assist you in obtaining more economical methods. There is no obligation for this service.



SIMPLEX RIGIDMILS

Either slab or face milling can be performed on this single spindle Rigidmil. This type machine can be furnished with 25, 30, 40, 50 or 75 horsepower heads. Table widths are 18", 24" or 30" and table feed strokes up to 168 inches. Larger or special sizes are available on request.



DUPLEX RIGIDMILS

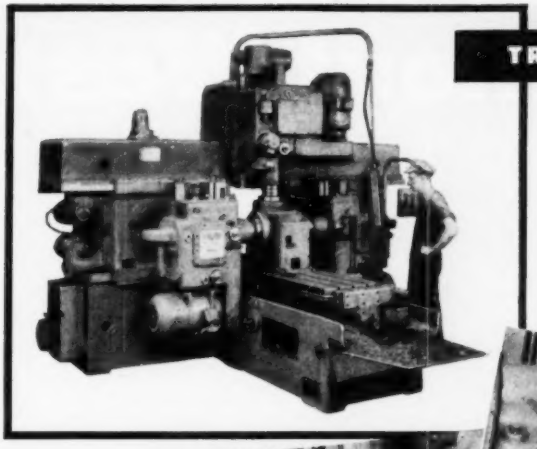
Machine has two horizontal opposed independently motor driven spindle heads which can be furnished in 15, 25, 30, 40 or 50 HP capacities. Table widths are 18", 24" or 30" and table feed strokes up to 168 inches. Larger or special sizes are available on request.

Machine shown has spindle heads mounted on adjustable columns so as to handle a much wider range of work pieces. Power movement is provided for this column adjustment. A fixed column duplex type machine can be furnished if desired.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

TRIPLEX RIGIDMILS



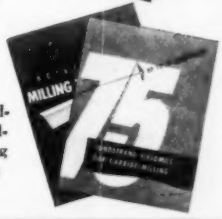
This highly productive Sundstrand Rigidmil has been developed to add flexibility to a production type milling machine so that both wide and narrow parts can be machined without sacrifice in accuracy. Three spindle heads, one vertical and two horizontal, can be adjusted to mill three sides of a work piece simultaneously or operate individually. Heads are independently motor driven and each can be furnished in either 15, 25 or 50 HP capacities. Machines can be furnished in table widths of 24″ and 30″ and feed strokes up to 168 inches with larger or special sizes available on request.

Magnetic *POWER-GRIP* Holding Methods and Devises

Illustrated above is a Model 22 Rigidmil equipped with a Power-Grip Magnetic Fixture for holding three shafts for a keyway milling operation. Use of a magnetic fixture not only simplified and speeded up the loading operation but reduced the cost of the work-holdng equipment over conventional holding methods. Magnetic fixtures are manufactured by the Sundstrand Magnetic Products Co. (formerly Rockford Magnetic Products Co.) which is now a division of the Sundstrand Machine Tool Co. Their Power-Grip Chucks are an easy solution to many work-holding problems. Their deep magnetic penetration eliminates the need for complex, expensive holding fixtures on either simple or odd shaped work pieces.
Write for bulletin number MC-188 on magnetic holding methods. Better still, send prints and specifications for our recommendations on Power-Grip holding equipment.

Additional Data

For more complete information on Sundstrand Simplex, Duplex and Triplex Rigidmils and Sundstrand Engineered Milling Methods, write for bulletins number 188



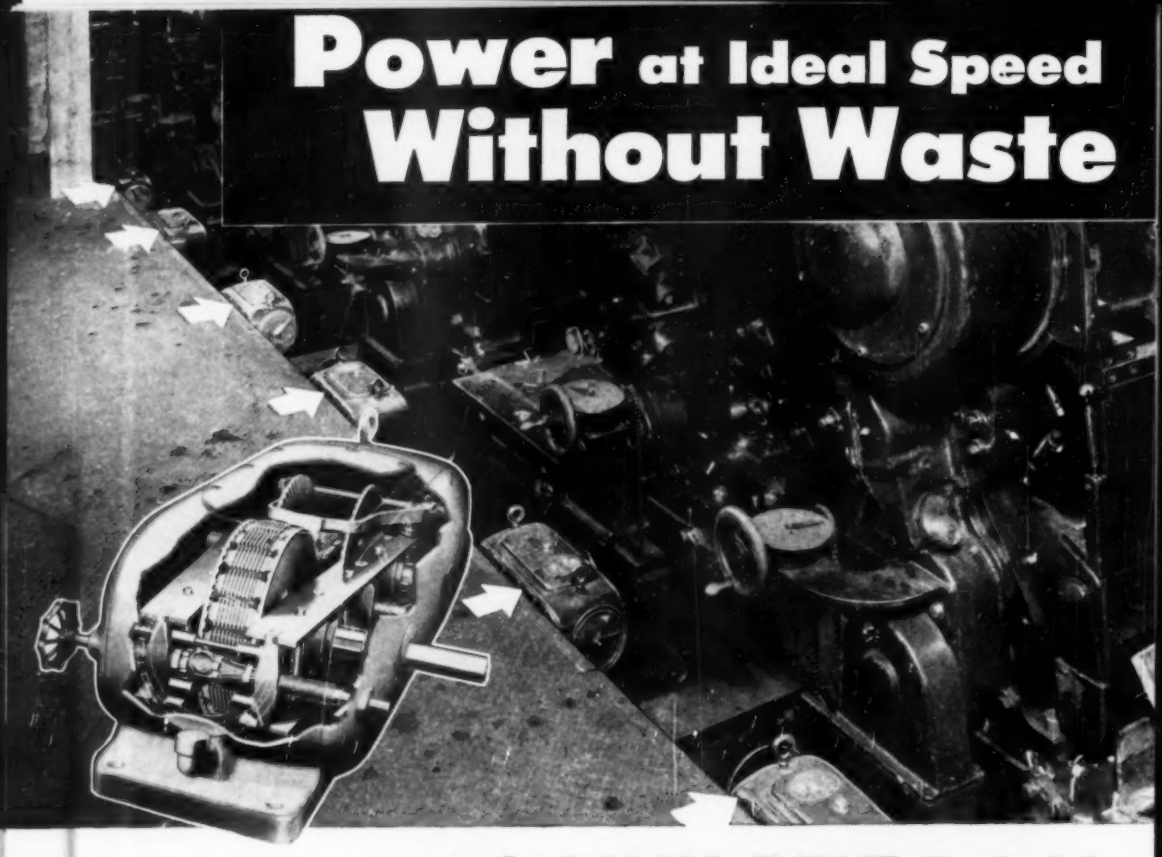
Automatic Index Bases

Illustrated above is a standard Sundstrand Automatic Index Base mounted on a milling machine table. The base is provided with eight stations with two parts held in each station. Table cycling and indexing are automatic. Consequently, the operator merely loads and unloads two parts while two are being machined. Production is 800 pieces per hour. Standard Index Bases are available in sizes from 8″ to 30″ in diameter. For more information, ask for bulletin number IB-188.

SUNDSTRAND
MACHINE TOOL COMPANY
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

Power at Ideal Speed Without Waste



Six arrows point to six Link-Belt H-1 P.I.V. Variable Speed Drives with mechanical remote handwheel control, on black printing units of new Wood newspaper press.

with LINK-BELT P. I. V. VARIABLE SPEED DRIVE

Link-Belt P.I.V. Variable Speed Drive is available in vertical or horizontal housings, with or without extra reduction gears, and motor, or without housing, for built-in purposes.

Supplied in eight types, up to 25 h.p., fully described in Data Book 1874-B. Send for your copy *NOW!*

You can run any machine at its ideal speed for maximum production by using the Link-Belt P.I.V. Variable Speed Drive.

This unique device furnishes positive power transmission through a chain which automatically forms its own teeth, assuring transmission of every r.p.m. without the possibility of slip or wasted power.

Output speed is instantly variable while the machine is running, and speed ratios are infinite, without steps. Once adjusted, the speed ratio remains constant indefinitely—until changed by means of the convenient hand wheel.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices, Factory Branch Stores and Distributors in Principal Cities. 11,609

LINK-BELT

THE SYMBOL OF QUALITY — LB — LINK-BELT

Power Transmission Machinery

"THE COMPLETE LINE"

TYPES OF LINK-BELT POWER TRANSMISSION MACHINERY

Precision Steel Roller Chain	P.I.V. Variable Speed Drives
Silverstreak Silent Chain	Fluid Drives
Steel and Malleable Chain	V-Belt Drives
Worm Gear Drives	Ball Bearings
Herringbone Gear [illegible]es	Roller Bearings
Helical Gear Drives	Babbitted Bearings
Gearmotors	Couplings, Clutches, Collars, etc.

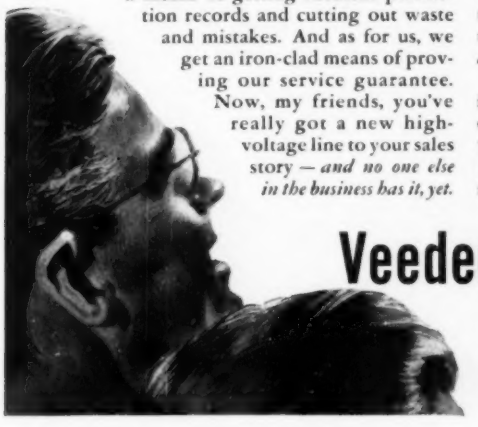
Brother Peddlers! . . .
Meet our New Star Salesman
. . . this built-in VEEDER-ROOT COUNTER*

LISTEN TO THIS SALES MANAGER: "First of the month, this counter goes into all our machines as standard, original equipment. This means *our customers get a new service* from our product—a means of getting accurate production records and cutting out waste and mistakes. And as for us, we get an iron-clad means of proving our service guarantee. Now, my friends, you've really got a new high-voltage line to your sales story — *and no one else in the business has it, yet.* Let's get going!"

That's an example of how "countless" products began to click faster in sales . . . *when they began to count.* For built-in Veeder-Root *Count*rol is a valuable extra service, a distinctive feature that talks business in the language of the toughest customer . . . *in plain, black-and-white figures.*

And these figures can be put to work in endless ways, for a poultry-physician or a map-maker, as the case may be. So why not for *you?* Don't say: "But my product can't count." Give it a chance to speak for itself . . . directly to *us.* Write.

*The Counter shown is a V-R Medium-Size Counter . . . about 4½" long, built into a long list of products to count strokes, turns, pieces, or what have you. It's one of scores of V-R counters shown in the 8-page condensed catalog. *Write for your copy.*

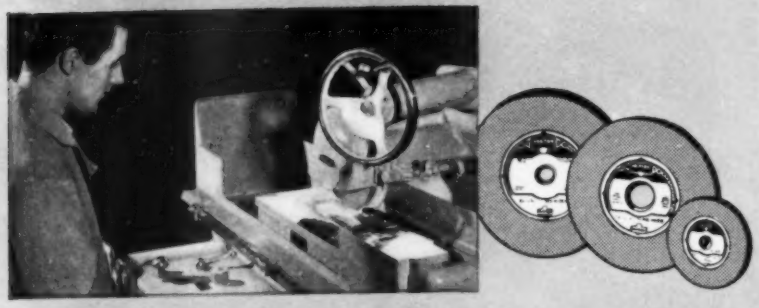


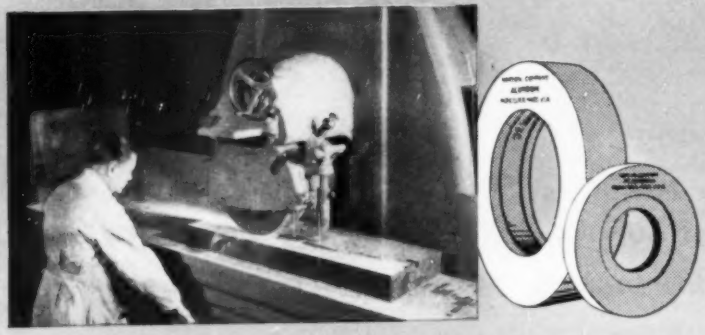
Veeder-Root COUNTERS

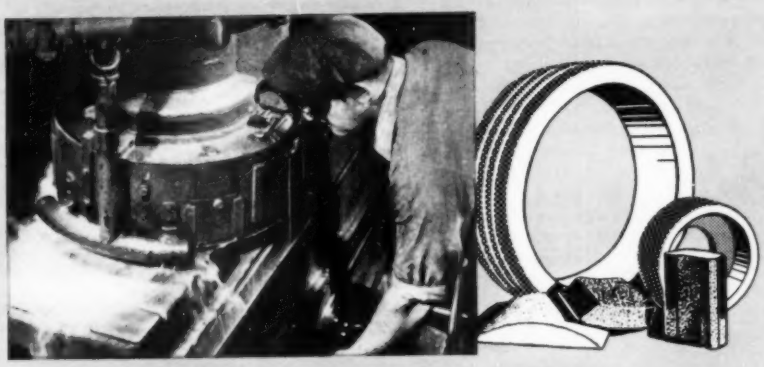
VEEDER-ROOT INC., HARTFORD 2, CONNECTICUT

In Canada: Veeder-Root of Canada, Ltd., 955 St. James Street, Montreal 3. *In Great Britain:* Veeder-Root Ltd., Kilspindie Road, Dundee, Scotland.

Looking for Lower







Abrasives · Grinding Wheels · Grinding and Lapping Machines · Refractories · Porous Mediums · Non-slip Floors · Norbide Products · Labeling Machines

Surface Grinding Costs?

Here's Real Help—

NORTON PRODUCT VARIETY TO MEET *EVERY* JOB REQUIREMENT

Straight wheels for the light tool room grinder or the big production job, cylinder and cup wheels in all sizes and including the plate mounted type, segments in sizes and shapes for all makes of chucks . . . a wide variety of abrasives including ALUNDUM, 38 ALUNDUM, 57 ALUNDUM, the unique 32 ALUNDUM and CRYSTOLON abrasives . . . several bonds including vitrified, BE vitrified, silicate and resinoid.

NORTON ENGINEERING "KNOW-HOW" TO SOLVE *EVERY* SURFACING PROBLEM

It's not enough to have the right wheel or segment for each surfacing job. Lowest cost can only come when they are properly selected for the job. And that's where Norton "know-how" is important. In every industrial center there are Norton abrasive engineers—each an expert in selecting the right product for your surfacing jobs. At Worcester there are engineering and laboratory specialists. Throughout the country there are over two thousand Norton distributor men—a large percentage of them factory-trained at Worcester.

Take advantage of the completeness of the Norton line and Norton engineering "know-how" to get all your surface grinding costs down to meet today's keen competition.

Outstanding for Surface Grinding . . . 32 ALUNDUM ABRASIVE

It's in the field of surface grinding that the sensational new 32 ALUNDUM abrasive has its widest application. The grinding wheel supervisor of one of the country's largest plants says, "The best wheel there is for all kinds of surface grinding—we don't consider anything else."

Have you tried 32 ALUNDUM to cut surface grinding costs?

NORTON ABRASIVES

W-1259

NORTON COMPANY, WORCESTER, MASS. New York, Chicago, Detroit, Cleveland, Philadelphia, Pittsburgh, Hartford, St. Louis, Los Angeles

ARMSTRONG
TOOL HOLDERS...
for the toughest steels!

The "Armstrong System" provides special ARMSTRONG TOOL HOLDERS for ARMALOY (cast alloy) and for ARMIDE (carbide-tipped) cutters. With these modern cutting tools, the toughest and hardest steels are easily machined. Far heavier feeds and the extremely high cutting speeds become practical (300 f.p.m. with ARMALOY cutters; 600 f.p.m. with ARMIDE cutters). Delays for tool re-grinding are reduced to an absolute minimum—edges hold up to 100 times as long.

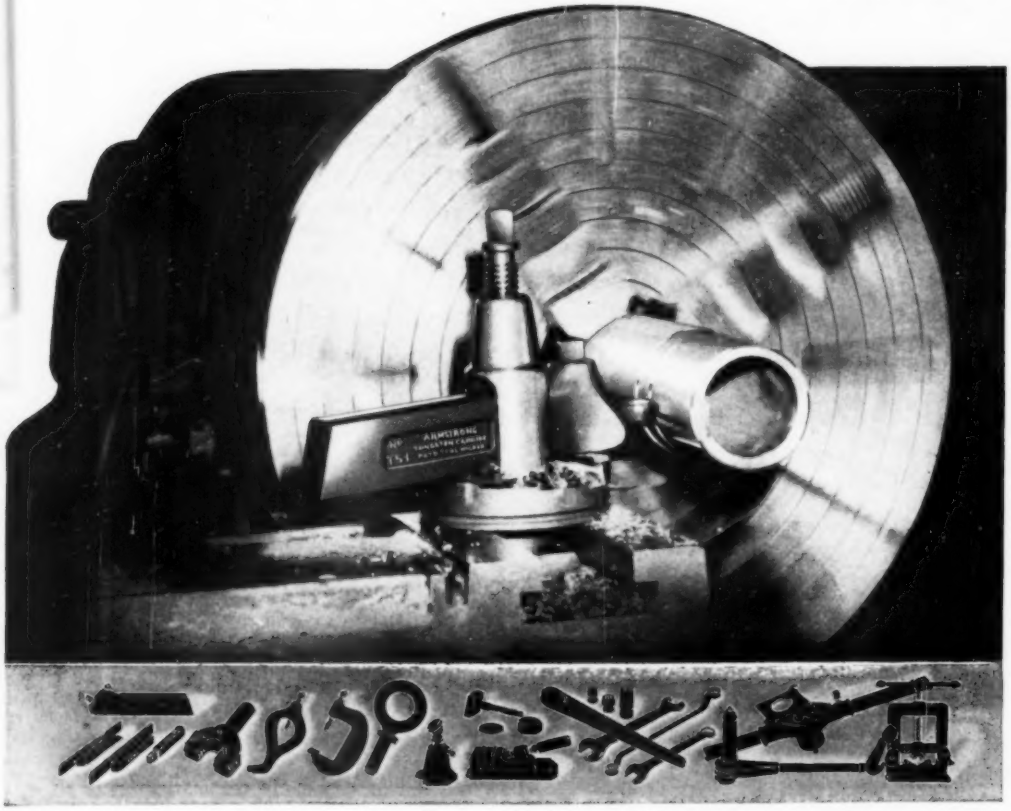
These new tool holders and cutters are stocked by your Local ARMSTRONG industrial distributors.

WRITE FOR CATALOG

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 West Armstrong Ave. **Chicago 30, U.S.A.**



Operators acclaim it as a money maker!

Whenever operators enthusiastically acclaim a feature, as a money maker for them it automatically follows that it is likewise a money maker for the owners.

The direct reading speed control of "AMERICAN" Pacemaker Lathes is a real money maker and operators freely admit it. It makes their work easier; they can secure the right speed quicker; they produce more work because of it and, what is of paramount importance, the pay roll dollar buys more as a consequence.

The direct reading speed control unit shows at a glance the available speeds and the simple means of securing them. Imagine 27 spindle speeds being secured through only two conveniently placed direct reading levers without having to refer to index plates or having to retain lever positions in mind.

Furthermore, the simplicity of this mechanism and the infinitesimal time required to make speed changes inspire operator confidence and encourage him to make changes necessary to secure correct cutting speeds.

This and other fine features of the "AMERICAN" Pacemaker are thoroughly illustrated and described by Bulletin No. 16.

THE AMERICAN TOOL WORKS CO., Cincinnati, Ohio, U. S. A. LATHES AND RADIAL DRILLS

How a BALDWIN PRESS helped BROWN to.

You may see one of the heads that the Brown Steel Tank Company's Baldwin Hydraulic Press is producing, next time you pass a tank truck on the highway. Brown is a leading fabricator in this field, and its products are serving throughout the nation.

The company reports a whole parade of advantages from the use of this Baldwin 1500-ton triple action Hydraulic Press.

First—a big increase in *business opportunity* because of unlimited possibilities in product design, and the ability to work larger sheet. These expanded opportunities were immediately reflected in a substantial increase in business booked.

Second—a decided increase in shop output. Elimination of bottle-necks of slow operations permitted all shop equipment to produce to capacity.

Third—a big increase in *productivity per man-hour*. Old hand-flanging methods were slow and costly. The husky, hefty Baldwin Press now stamps, forms and flanges in one smooth operation.

Fourth—*improvement of the product* through reduction of weight, because of the possibility of re-design, came with Baldwin Press production. This permitted the steel allocation to be stretched over a greater number of jobs.

Baldwin experience includes production of all sizes and types of presses, for both jobbing and highly specialized operations. You'll find this know-how a big help in *defining* your exact press requirements—and *designing* a unit to meet them. For a quick picture of what Baldwin has to offer, ask for Bulletin 285.

The press extends 26′-8½″ above the floor, and 19′-10½″ below it. Bed dimensions are 84″ x 133″. Plunger stroke is 37″. Shut height of press 72″. Cushion stroke 12″. Drawing capacity depth 13″ to 22″. Inner slide capacity 600 tons; outer slide, 300 tons; lower action, 600 tons. It offers the custom-built advantages that have made Baldwin presses outstanding producers in the metal forming field: complete operator control of the slide during every portion of the working and return stroke, easy die interchange, full pressure availability regardless of stroke used, small number of working parts, and rugged design that minimizes maintenance.

Brownie city delivery trailer with 4000 gallon four-compartment tank.

BLW THE BALDWIN GROUP

The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A.
Offices: Boston, Chicago, Cleveland, Houston, New York, Philadelphia, Pittsburgh, San Francisco Seattle, St. Louis, Washington. In Canada: Baldwin Locomotive Works of Canada, Ltd., Toronto, Ontario.

BOOST BUSINESS

EXPAND PRODUCTION

. . . INCREASE MAN-HOUR OUTPUT

IMPROVE PRODUCTS

This press gave Brown a new sales story, was advertised to prospects.

BALDWIN

HYDRAULIC PRESSES

-another Pratt & Whitney *"First"*

The NEW *M* SERIES KELLERFLEX

WITH 16 CONSTANT SHAFT SPEEDS

Here's the greatest advance in flexible shaft machine engineering in 25 years . . . the "Series M" KELLERFLEX, newly designed and built by master craftsmen to famed P&W precision standards.

First time you use it, you'll *feel* the difference. It's so much easier to operate, so much more convenient. IT MAKES CRAFTSMEN.

And you'll *see* the difference in your operators and their results, for these "Series M" Machines are entirely new mechanical muscles that put more power in good hands for the easier, faster, truer shaping and finishing of anything . . . *by better burring . . . filing . . . sanding . . . grinding . . . wire brushing . . . polishing.* Check the new features, and you'll see what we mean.

New Bulletin just off the press. You'll find it pays to know the "how" of KELLERFLEX and why the "Series M" is the most versatile machine in the shop. Just send a card for your copy.

Some of the
NEW FEATURES . . .

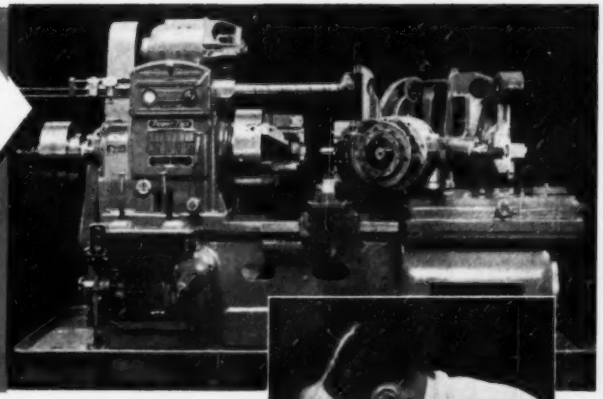
This Machine has 16 constant shaft speeds — 1000 to 6000 rpm, or 2000 to 12,000 rpm — obtained by pulleys*. Upper photo shows how a simple twist of the wrist changes speeds in the standard range; no tools required. Lower photo shows how cable is piloted (on ball bearings) for smooth operation — away from the pulley, a design feature to protect operator and work. Standard heavy duty ¼ to ½ hp. motor with overload protection. "Series M" KELLERFLEX comes to you permanently balanced for floor or bench stand or suspension, with standard fittings for standard equipment.

**A still wider range of speeds can be obtained by using the KELLERFLEX High Speed Attachment (ratio 1:3) on this new "Series M" Machine.*

Pratt & Whitney
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT

P&J TOOLING on P&J AUTOMATICS

does the (w)hole job *better — faster cheaper*



Production costs mount up fast when multiple drilling requires extra work handling, extra machining, extra time, often extra machines. You avoid all these "extras" when the job is done — *in one holding* — with P&J TOOLING on P&J AUTOMATICS.

There's no secret to the P&J method. It's simply skillful tool engineering based on 50 years of specialized experience. Typical examples of P&J Tooling are these self-driven Multiple Spindle Drill Heads — all designed for drilling, countersinking or reaming multiple holes directly from the turret of a P&J Automatic. They index to exact alignment, engage with the work chuck which rotates the Drill Head; drive is transmitted in correct speed ratio to the drills. The (w)hole operation is fast, precise, fully automatic — and results in better work, and more of it at lowest possible cost per unit.

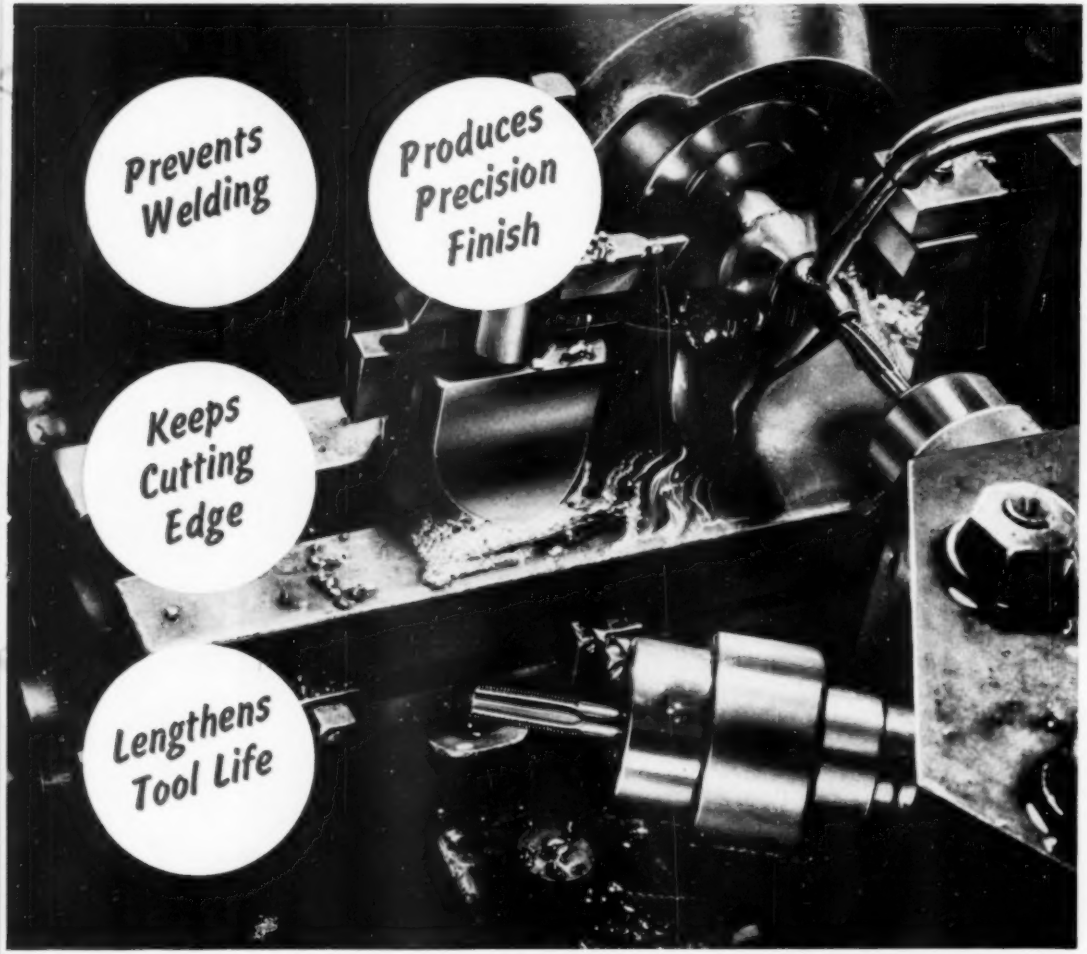
When multiple drilling is part of your machining problem, get a cost and time estimate from P&J. It's a profitable habit to acquire.

Potter & Johnston Company
Pawtucket, R. I.
subsidiary of Pratt & Whitney
Division Niles-Bement-Pond Company

P&J

PRODUCTION TOOLING HEADQUARTERS

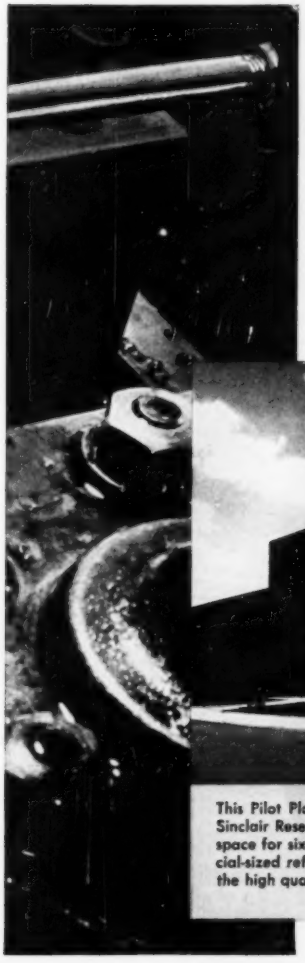
SINCLAIR AUTOKUT and Lengthens Periods



SINCLAIR

YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE

Masters Tough Steels Between Grinds



Hard-to-cut steels are a problem in the production plant. They are hard on tools and make frequent changing necessary. This means loss of costly man and machine hours.

Sinclair AUTOKUT meets the challenge of tough steels. Specially compounded, AUTOKUT is built for severe service in difficult operations such as threading, tapping and heavy-duty broaching. AUTOKUT prevents welding at the tool point to maintain an effective cutting edge and to insure production of more perfect pieces of work per grind. To turn out piece after piece of uniform finish and to lengthen periods between grinds, try Sinclair AUTOKUT.

This Pilot Plant, part of the new multi-million dollar Sinclair Research Laboratory at Harvey, Ill., provides space for six miniature operating replicas of commercial-sized refinery units. Continuous research explains the high quality of AUTOKUT and other Sinclair Oils.

Making a study of crystal structure of catalysts, this Sinclair researcher at Harvey uses physical chemistry to develop refinery techniques in a never ending effort to bring industry better petroleum products at lower costs.

INDUSTRIAL OILS

FOR LUBRICATION COUNSEL, OR YOU MAY WRITE TO SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.

up from the minor leagues

comes stainless sheet and strip

Stainless steel has now moved up to the major leagues. Advances in strip mill techniques have played an important part. Now, CRUCIBLE, using the best of these accepted modern techniques, plus exclusive ones of its own . . . is producing stainless by specialty steel production methods at the busy Midland Works. In the *first* mill *specifically* built for the production of stainless, top steel specialists are putting to good use $18,000,000 of new tools and buildings. When the leader in the specialty steel field applies specialty steel production methods to stainless, you can rightly expect that from CRUCIBLE you'll get the best that a half century of experience and modern tools can provide.

new tools for a **MASTER** mechanic

The new mill will produce stainless in widths of ½" to 50" inclusive, in all gauges, grades and finishes. This is important news to users of stainless steels, because with Trent Tube Company joining the organization, you can get stainless from CRUCIBLE in every form: sheets, strip, plates, bars, wire, forgings, castings and tubing. CRUCIBLE offers comprehensive data sheets and unsurpassed metallurgical service. Your inquiries are welcome.

CRUCIBLE STEEL COMPANY OF AMERICA
405 Lexington Ave., New York 17, N.Y.
Branches, Warehouses and Distributors in Principal Cities

CRUCIBLE first name in special purpose steels

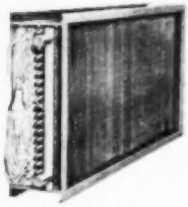
hot and cold rolled **STAINLESS SHEET AND STRIP**

STAINLESS • HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE • STEELS

READY!
THE ALL NEW--
STURTEVANT
AIR HANDLING UNIT
--STABLE
PERFORMANCE,
NEW FLEXIBILITY

Refrigeration Compressors

Axial Flow Fans



Heating and Cooling Coils

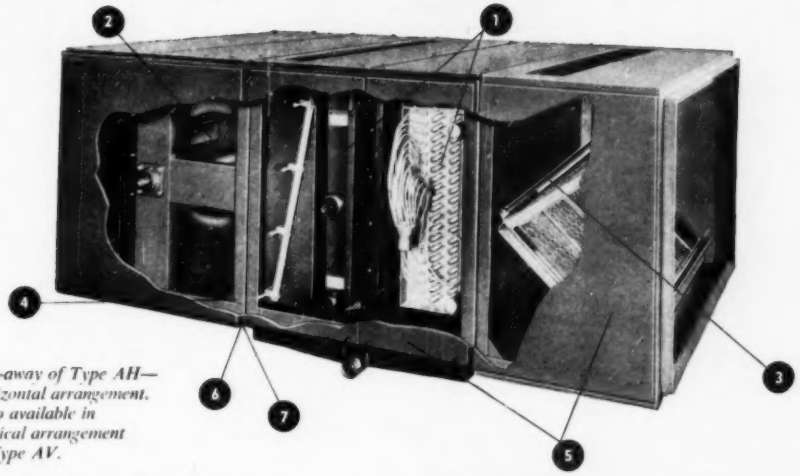
Everything that puts air to work for Every application

Refrigeration Condensers

Centrifugal Fans

Unit Air Conditioners

J-80154



Cut-away of Type AH—horizontal arrangement. Also available in vertical arrangement —Type AV.

1. ALL TYPES OF COILS AVAILABLE
—for well water, chilled water or Freon, as well as hot water or steam—a complete line.

2. STABLE, QUIET FAN OPERATION
—with a revolutionary fan design. Non-overloading horsepower, steep stable pressure characteristic, certified performance.

3. MINIMUM INTERNAL RESISTANCE
—static pressure requirements kept low. Ample filter area, plate-type fins, eddy-free flow.

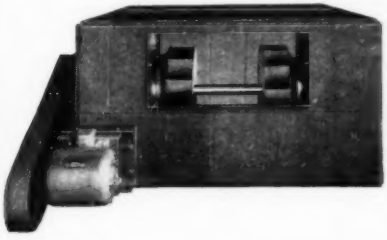
4. RUGGED, INSULATED CABINET
Sectionalized casing with welded, gussetted structural angle frames and insulated panels.

5. EXCELLENT MAINTENANCE ACCESSIBILITY
—wide, gasketed, hinged doors for easy filter removal. Fan and coil section panels removable.

6. FLEXIBLE DESIGN
—sectional construction permits wide variety of assembly arrangements and uses.

7. EASY TO ASSEMBLE AND INSTALL
—shipped in sections for ease of handling. Single outlet simplifies duct work.

8. UNDIVIDED RESPONSIBILITY
—fans, coils, motor . . . every *major part a product of* one *manufacturer. You can't get this vital, plus-value anywhere else!*

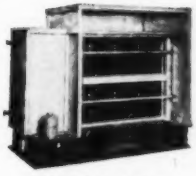


This announcement is important to you. For the complete story of these new units, including their selection and application, call your nearest Sturtevant office, or write Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

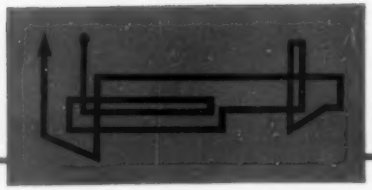
Westinghouse
Sturtevant Division

Unit Heaters

PRECIPITRON *
(Electronic Air Cleaner)

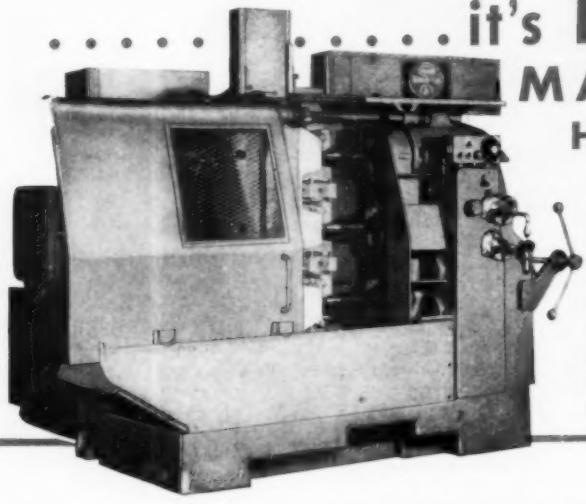


Surface Dehumidifiers

Follow this  Tool Path

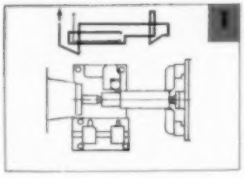
. . . . . it's BULLARD

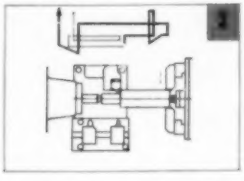
MAN-AU-TROL HORIZONTAL LATHE MODEL 30H

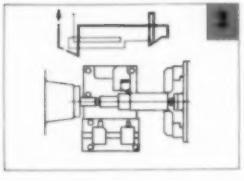


For Between Center Work On Shafts And Chucking Jobs Requiring — *Turning* — *Grooving* — *Facing* — *and Angular Turning.*

Fully automatic for Production runs or operated manually for short runs without disturbing the automatic setup.



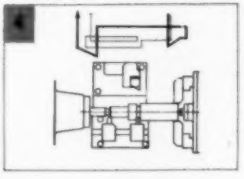


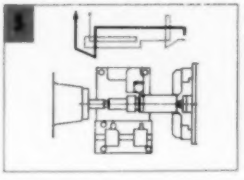


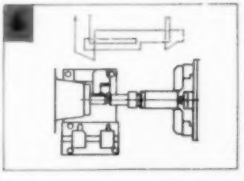
Man-Au-Trol has no predetermined sequence of operating functions, except when set for a given job. No cams are used for the movement of saddle or tool slide or for dwell at the end of a cut. Repetitive accuracy and uniformity of finished work is assured. 1 Drive pinion Shaft SAE 3250 Bar Stock steel (size 3" x 11¾") 1st. Oper. rough turn. 2 2nd Oper. Finish turn to size. 3 3rd Oper. finish turn to size. 4 4th Oper. Lower tools groove and chamfer end. 5 5th Oper. Upper tool enters groove generates 30 degree angle and finish turns to shoulder. 6 6th Oper. finish face end of shaft. Production per hour 52 pieces.

16MM SOUND MOTION PICTURE

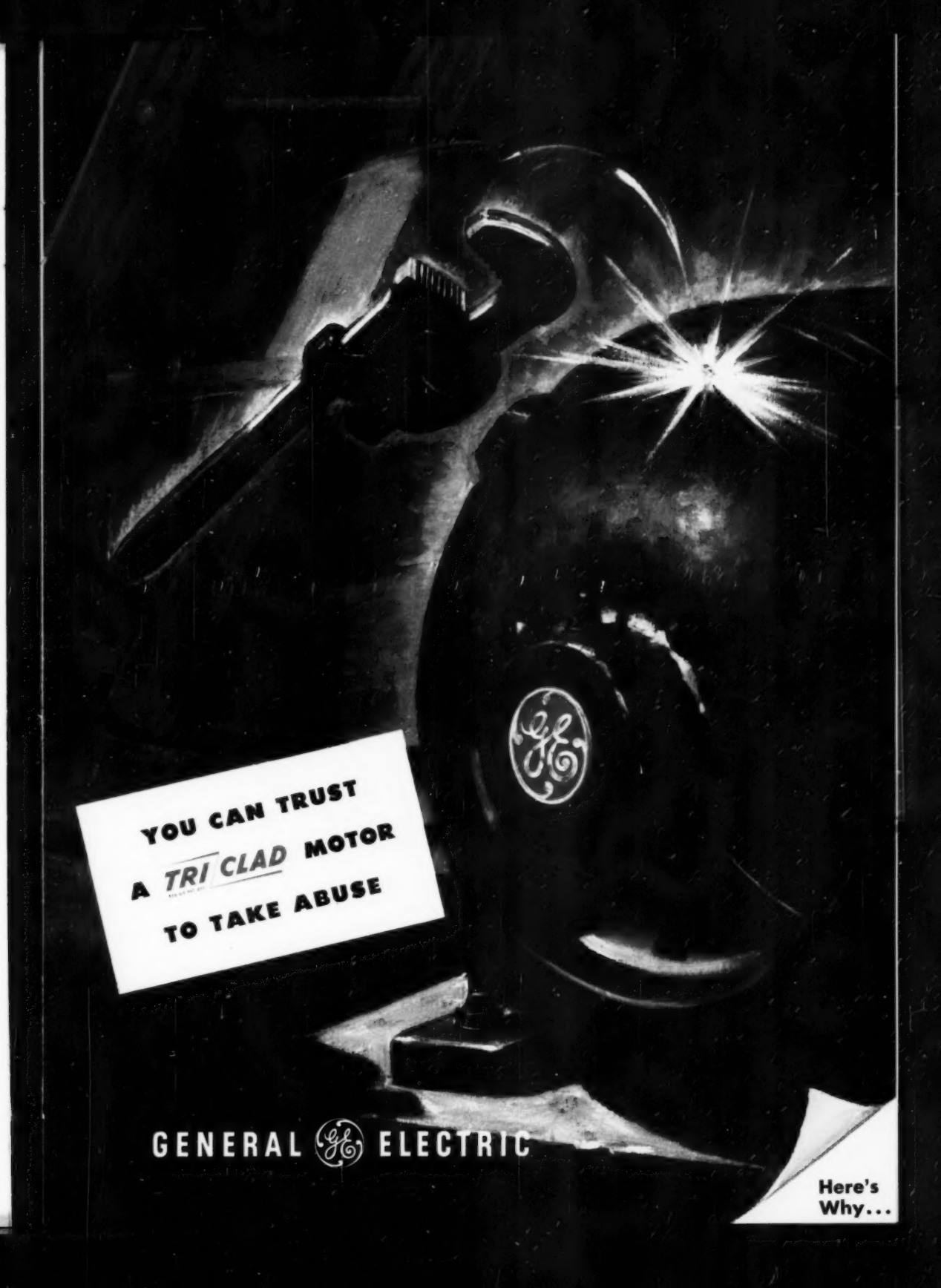
Showing the setup and operation of the Bullard 30H Lathe is available for group showing. — When writing advise your preferred date.

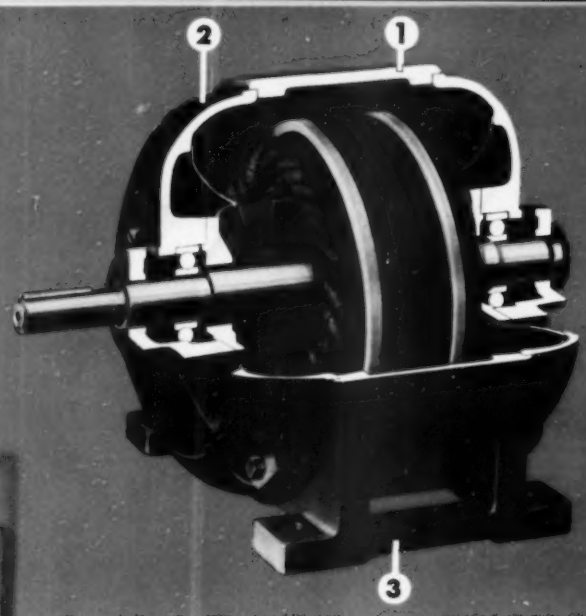






THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT


YOU CAN TRUST
A TRI CLAD MOTOR
TO TAKE ABUSE
GENERAL ELECTRIC
Here's
Why...



Notice the thick cross sections of a Tri-Clad's husky cast-iron stator frame (1) and end shields (2) . . . the integrally cast feet (3). Here you have a *rigid structural unity* that no other general purpose motor we've seen can match. Distortion of bearing alignment is well nigh impossible, even by severe blows, careless installation, or the heavy continuous radial loads some industrial drives impose. Notice, too, how Tri-Clad double-end ventilation provides *uniform* "air conditioning" throughout the motor.

You can trust a *TRI CLAD* motor to take abuse

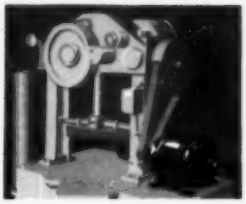
Teeth-rattling blows—accidental jarring—dripping liquids—they're all in a day's work for a Tri-Clad motor—the toughest general-purpose motor that hard-headed plant management can buy.

The cast iron structure which today protects more than a million and a half Tri-Clad motors, is one big reason for its stamina. It absorbs the shock of accidental blows and falling objects encountered in rigorous industrial service. It provides vastly superior resistance to rust and corrosion. Moreover, cast iron won't take on an injurious permanent "set"; thus it assures accurate shaft alignment and a permanent air-gap for the life of the motor. Thick-ribbed cast-iron end shields, too, take more than their share of punishment.

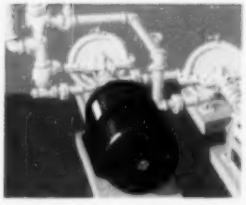
Want to standardize on a line of motors that can really **TAKE ABUSE?** Local stocks of Tri-Clad motors in your area mean **QUICK DELIVERY.** *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

YOU CAN'T BEAT TRI CLAD EXTRA PROTECTION



G-E open (drippproof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.



G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.

G-E vertical induction motors for pump drive, in streamline design. From 1 to 500 hp.

G-E capacitor motors for use on fans, blowers, pumps and compressors, with single-phase power. From ¼ to 5 hp.

Look for this **EXTRA** on the motor you buy!

150S

WORLD'S MOST VERSATILE ALUMINUM ALLOY

NOW HERE TO CUT COSTS—YET IMPROVE PRODUCTS

Here are important facts about a remarkable new Kaiser Aluminum Alloy:

Unusually versatile—a cold rolled alloy that's stronger than 3S, more workable than 52S.

First alloy ever developed specifically to meet problems of fabricators and engineers.

Thoroughly proved in two years of research, testing and practical production experience.

Exclusive Permanente Metals' development.

If you are now using 3S or 52S, you may be able to cut material costs and give your product better design by using Kaiser Aluminum Alloy 150S.

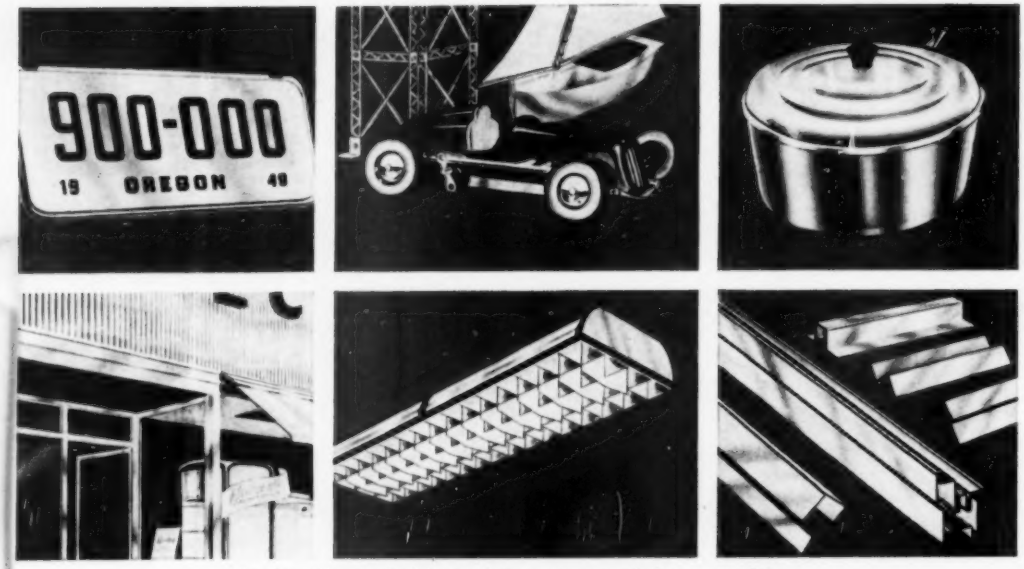
On the next page, read about the unique combination of advantages of...

150S—Remarkable New

***Kaiser Aluminum* Alloy**

150S . . . WORLD'S MOST

NOW HERE TO CUT COSTS—YET IMPROVE PRODUCTS



No other alloy can be fabricated in so many ways to do so many jobs—because no other alloy so effectively combines ALL *these advantages:*

GOOD PHYSICAL PROPERTIES. Yield strength and workability have been established to make it suitable for the widest variety of applications.

GOOD WORKABILITY. Most single, double and triple stage drawing can be done. With proper equipment spinning can be done satisfactorily. Beading formed by dies in a press can be handled well. Roll forming, brake forming, and lock seaming can be accomplished easily.

VERY FINE GRAIN STRUCTURE. Its chemical composition makes Kaiser Aluminum 150S inherently a fine grain alloy, uniform in all tempers.

EXCEPTIONAL FINISHING PROPERTIES. Satin anodized finishes, with a silvery white color, fine texture and consistent uniformity, can be obtained. Many finishing operations can be eliminated. And the hard surface resists scratches.

GOOD WELDING AND BRAZING PROPERTIES. Heliarc welding, spot welding and brazing can be done.

EXCELLENT CORROSION RESISTANCE. 150S has salt corrosion resistance properties comparable to 52S.

ARE YOU NOW USING 3S?

Here are definite advantages you get with 150S:

- 30 to 40 per cent greater strength in finished parts.
- Very nearly the same workability you now get with 3S.
- Harder, more scratch-resistant surface.
- Uniform, finer grain texture in all tempers.
- Fast, high lustre buffing.
- Superior etch finishes—clear, white, uniform.
- Anodized finishes superior in color to 3S.
- Up to 10 per cent less material cost where extra strength allows gauge reduction—only slightly higher cost for equal gauges.
- Corrosion resistance, welding and brazing properties equal to or better than *3S.*

ARE YOU NOW USING 52S?

These advantages will be yours with 150S:

- Superior workability.
- Decided cost advantage if you're using 52S overstrength.
- No Lueder lines or strain markings in shallow draws.
- Finishing characteristics, corrosion resistance, welding and brazing properties equal to or better than *52S.*

Kaiser Aluminum Alloy 150S may offer you sufficient strength at low cost to make conversion to aluminum from other materials *permanent* and *profitable.*

VERSATILE ALUMINUM ALLOY

TYPICAL TENSILE PROPERTIES OF VARIOUS 150S TEMPERS

Here are typical figures for thicknesses of about .040″ to .051″. Elongations are slightly lower for thinner sheet, slightly higher for thicker sheet.

Temper	Tensile strength	Yield strength	Elongation % in 2″
150S O	21,000 p.s.i.	8,500 p.s.i.	25%
150S H 22	23,500 p.s.i.	16,500 p.s.i.	13%
150S H 32	25,500 p.s.i.	21,000 p.s.i.	9%
150S H 34	28,000 p.s.i.	24,500 p.s.i.	6%
150S H 36	30,000 p.s.i.	27,000 p.s.i.	5%
150S H 38	32,000 p.s.i.	29,000 p.s.i.	5%
150S H 18	33,000 p.s.i.	31,000 p.s.i.	4%
150S H 19	37,000 p.s.i.	35,000 p.s.i.	3%

But that's not the whole story of the greater strength of 150S! Here are typical yield strengths of 150S compared with 3S:

Yield strength, p.s.i.				% increase with 150S
3S O:	7,000	150S O:	8,500	21.5%
3S H 12:	17,000	150S H 32:	21,000	23.5%

When drawn parts of the two alloys are compared, the difference in strength is even greater! Here, for example, is a comparison of drawn parts of a refrigerator crisper pan:

	Yield strength, p.s.i.		% increase with 150S
Test location	3S	150S	
Side	19,200	26,100	35.9%
Flange	17,700	24,500	38.4%
End	16,400	22,300	36.0%

GET THESE COMPETITIVE ADVANTAGES WITH 150S: If you are now using 3S, 52S, copper, brass, steel, or other materials, you may be able to cut manufacturing and equipment costs—and improve your product and fabrication techniques—with Kaiser Aluminum 150S! Today—call or write the nearest Permanente Products' sales office for more information on the world's most versatile aluminum alloy—150S!

See production samples of Kaiser Aluminum Alloy 150S at the *Annual National Metal Congress and Exposition—Cleveland, October 17–21.*

Permanente Metals

PRODUCER OF

Kaiser Aluminum

SOLD BY PERMANENTE PRODUCTS COMPANY, KAISER BLDG., OAKLAND 12, CALIFORNIA . . . WITH OFFICES IN:
Atlanta • Boston • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Portland, Ore. • Seattle • Spokane • St. Louis • Wichita
EXPORT OFFICE, OAKLAND, CALIFORNIA • WAREHOUSE DISTRIBUTORS IN PRINCIPAL CITIES

There's Nothing Else Like It: USERS GAIN IN PRODUCTION

Here's picture-story of how 43% reduction in floor-to-floor time was accomplished on this job. Simple vise type fixture holds 4 workpieces at a time. Operator takes only few minutes to set up for *Mono-Lever* controlled automatic cycle . . . for rapid traverse to point of cut, feed through cut, rapid traverse reverse to starting point and stop for reload. Note that the operator engages *Mono-Lever* control *once* — at start of each cutting cycle. No other attention is necessary. While machine is running operator inspects and burrs finished pieces.

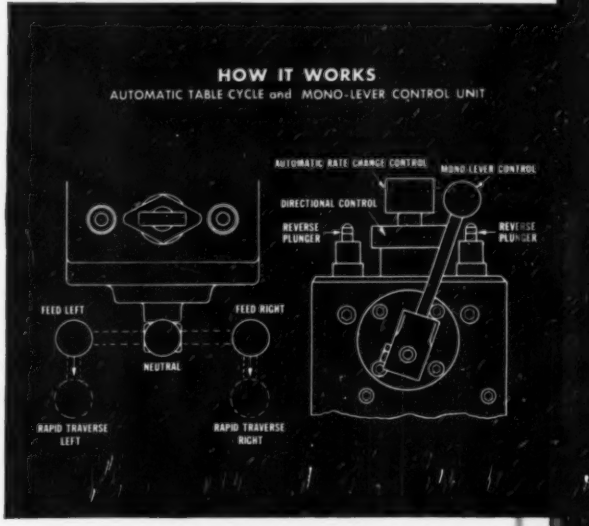
REPORT 16% TO 96% AND LOWERED COSTS

YOU bet there's nothing else like it! We mean the results users are getting with Kearney & Trecker's *new line of* knee-type milling machines with combined *Mono-Lever* control and Automatic Table Cycle. These users are cost-conscious plants. They know what they're talking about when they report increased efficiency — savings of 16 — 31 — 43 — 96% on all kinds of milling work.

Yes, more and more alert, cost-minded production men are buying these new Kearney & Trecker milling machines. Why? Because they've seen the five important profitable things these machines can do: (1) slash idle cutter time; (2) reduce operator fatigue; (3) improve uniformity of finished work; (4) provide greater adaptability in their shop equipment; (5) *return their investment faster.*

Compare these machines with all others on this important five-point basis. You won't be disappointed!

For some startling facts about these new machines as applied to your milling work, consult a Kearney & Trecker Sales Representative, today. Schooled in the "know-how", he's at your service — or write direct: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.



THINK OF IT! Now you can have all the advantages of this great cost-cutting feature plus the all-around versatility of general purpose, knee-type machines . . . faster, easier control for greater production with less operator fatigue.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

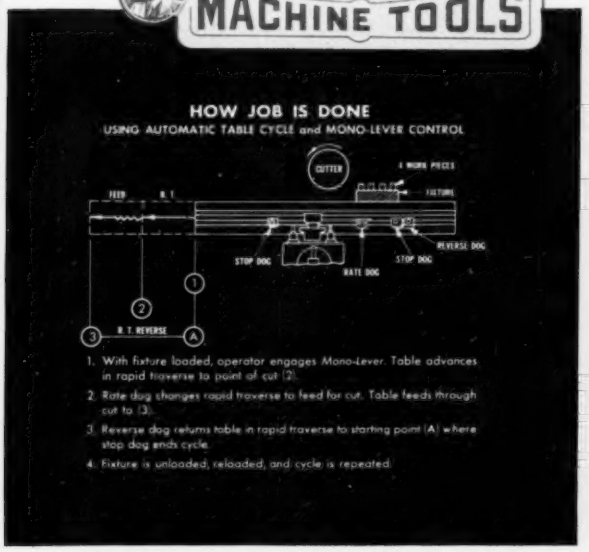
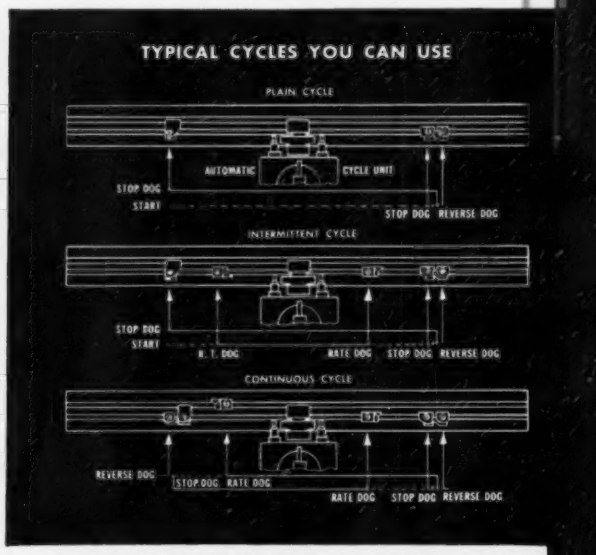

HOW JOB IS DONE
USING AUTOMATIC TABLE CYCLE and MONO-LEVER CONTROL
CUTTER
4 WORK PIECES
FEED
R. T.
FIXTURE
REVERSE DOG
STOP DOG
RATE DOG
STOP DOG
1
2
3
R. T. REVERSE
A
1. With fixture loaded, operator engages Mono-Lever. Table advances in rapid traverse to point of cut (2).
2. Rate dog changes rapid traverse to feed for cut. Table feeds through cut to (3).
3. Reverse dog returns table in rapid traverse to starting point (A) where stop dog ends cycle.
4. Fixture is unloaded, reloaded, and cycle is repeated.

DIAGRAM above shows how machine with new *Mono-Lever* control mills workpieces without operator's constant attention. Note how quickly control engages feed from rapid traverse — eliminating hand "inching" to cut — leaving operator free to inspect and burr workpieces.



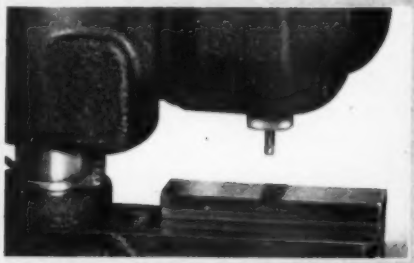
THREE DIFFERENT TYPICAL CYCLES to accommodate various job setups. Using the completely automatic cycle feature effects savings of up to 31% for lots of 10 or more pieces. Cycle can be set for loading and unloading time — and can be reversed in feed or rapid traverse.

...Is your plant benefiting, too,

from using wear-resistant NORBIDE® gages?

Plug and Ring Gages

Air Gage Spindles



Inserts for Gage Anvils

Now, more than ever, economy-minded plants are finding that their investment in NORBIDE Gages is paying off. The great wear-resistance of NORBIDE gage parts enables them frequently to outlast ordinary gage materials as much as 200 times.

Solid and hollow NORBIDE cylinders are made for plug gages, ring gages and air gage spindles. Other shapes are available for the anvils and spindles of snap gages and the contact points of a variety of dial indicator gages.

NORBIDE Gages are manufactured from Norton Boron Carbide — "the hardest material made by man." If you are not already benefiting from the long-wearing qualities of NORBIDE Gages, ask your regular supplier about them, or write direct to:

NORTON COMPANY
Worcester 6, Massachusetts

NORTON **NORBIDE PRODUCTS**

Wide range... right selection...

500 Series Hydraulic Pumps to fit your needs

Improve the efficiency and dependability of your hydraulic systems by selecting a pump best suited to the specific job.

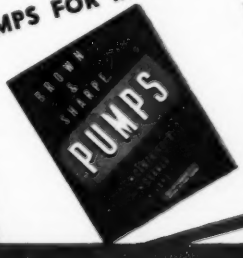
Among the wide variety of pumps offered by Brown & Sharpe for hydraulic systems is the 500 Series. These pumps operate at especially high efficiencies and are long-lived and reliable. Equipped with herringbone gears of heat treated steel, these pumps run quietly at high speeds under pressures up to 500 lbs. p.s.i. Their speed characteristics are designed for direct motor drives.

OUTSTANDING FEATURES

- 6 sizes. Capacities—5.1 to 37.6 g.p.m. at 0 lbs. pressure at 1140 R.P.M.
- Moving parts balanced hydraulically for end thrust.
- Distinctive design mechanical seal requires no adjustment.
- All surfaces ground to oil-tight fit and held to close tolerances.
- Flange stand available to meet practically every mounting condition. Facilitates assembly of duplex and motor driven units.
- Direction of rotation easily changed.

These and other design and construction features contribute to top performance records established by the Brown & Sharpe 500 Series Pumps. Count on them to help make your hydraulic systems efficient, dependable and economical. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

PUMPS FOR MANY APPLICATIONS

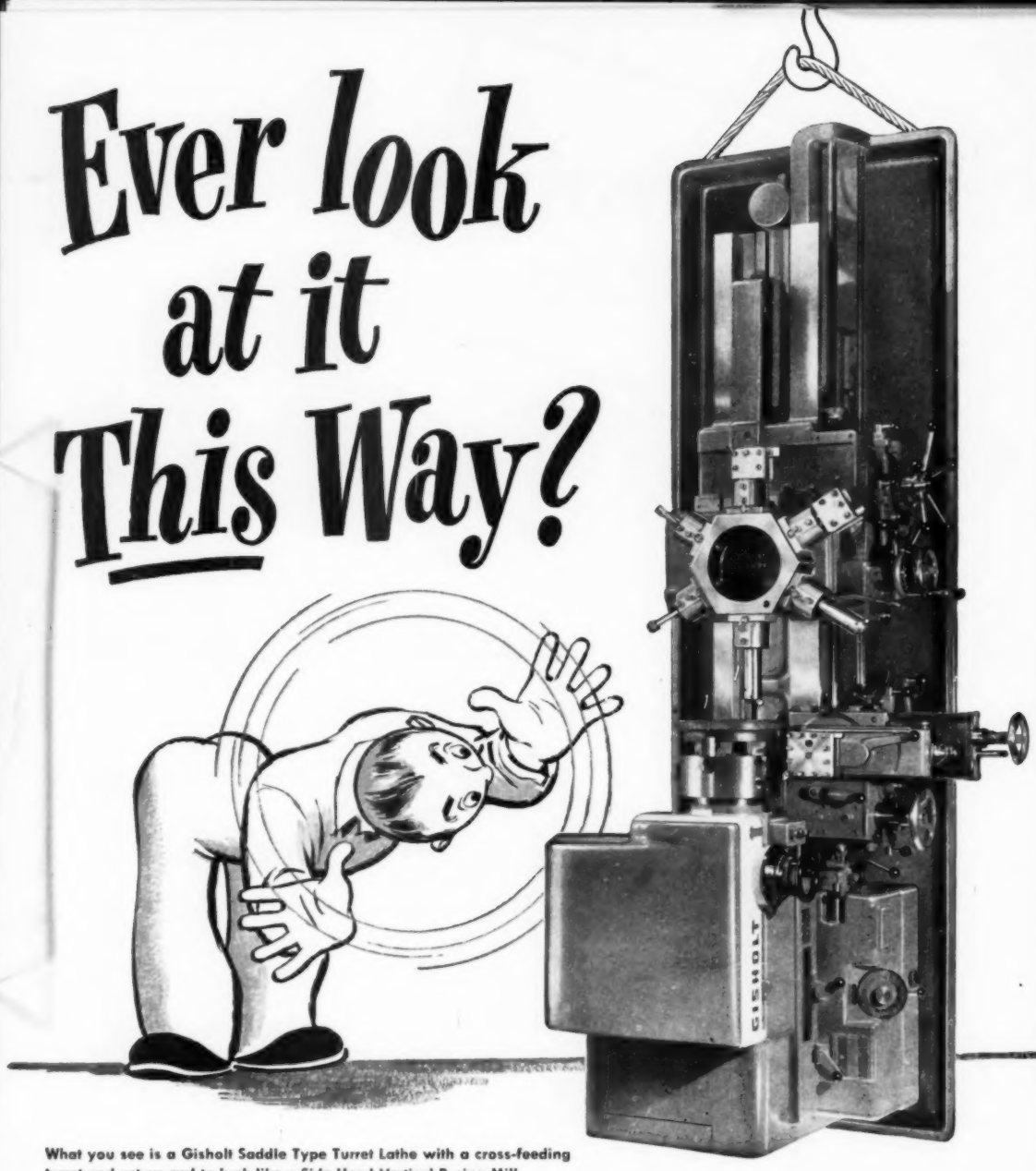


Brown & Sharpe pumps provide reliable means for circulating liquid for coolant purposes, for lubrication and for many other installations in addition to hydraulic. The complete line is shown in the latest pump catalog. Write for a copy.

We urge buying through the Distributor

BROWN & SHARPE PUMPS BS

Ever look at it This Way?



What you see is a Gisholt Saddle Type Turret Lathe with a cross-feeding turret and set on end to look like a Side Head Vertical Boring Mill.

This Turret Lathe is ideal for varied work on small lots. The cross-feeding hexagon turret will bore, face, recess, thread or otherwise finish the interior of the workpiece. The square turret on the side carriage will meanwhile face, turn or chamfer the OD. When necessary, you can pilot the hexagon turret tools or make other use of the hollow spindle. And all this is done with simple, inexpensive, easily set up tools.

Investigate the five basic sizes of the Gisholt Saddle Type Turret Lathe. Each is available with the money-saving cross-feeding turret.

THE GISHOLT ROUND TABLE

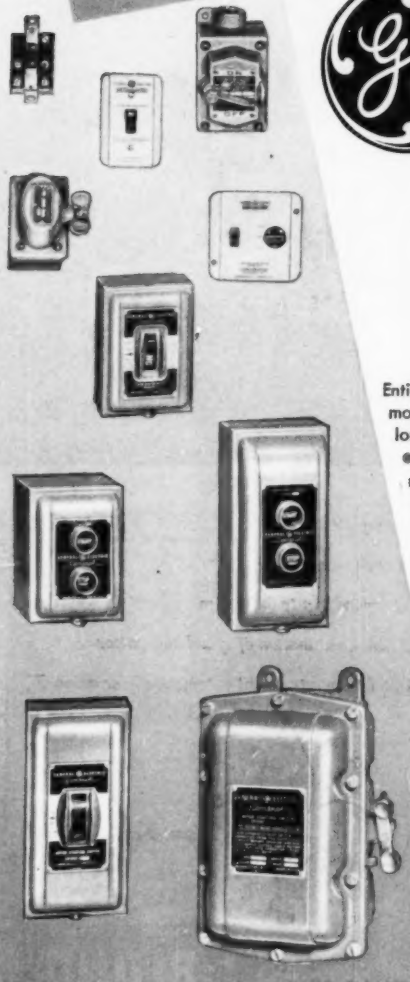
represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

more for your money



NEW manual motor starters

- **new, improved features**
- **wider selection**

Entire line of G-E manual starters—for fractional up to 7½ horsepower motors—now offers new design features that mean easier installation, longer operation at no increase in price. Here they are:

- A complete new line of pushbutton starters for controlling integral motors. Both pushbutton- and toggle-operated starters are available in the new four-pole form as well as the two- and three-pole forms previously offered.
- Bi-metallic overload protection—formerly found only in expensive equipment—provides quick, positive action, frequent resetting without wear. When relay trips, operating mechanism assumes neutral position, giving positive indication of overload trip.

All starters provide . . .

- heavy duty switch mechanism that resists vibration, stands up under frequent use . . . plenty of knockouts, lots of room in the sturdy grey case for wiring . . . dust tight, water tight, and explosion-proof as well as general purpose forms . . . and many other features described in the bulletins.

Whatever your requirements for small-motor starting, you'll find them met in G-E manual starters. Write now—buy now!

General Electric Company
Apparatus Dept., Section J 730-8
Schenectady 5, N. Y.

Please send me: Bulletin GEA-2234E on the CR1061 Manual Starter for F-hp motors .....and (or) Bulletin GEA-1522E on the CR-1062 Manual Starter for Integral Motors.

Name .....

Company .....

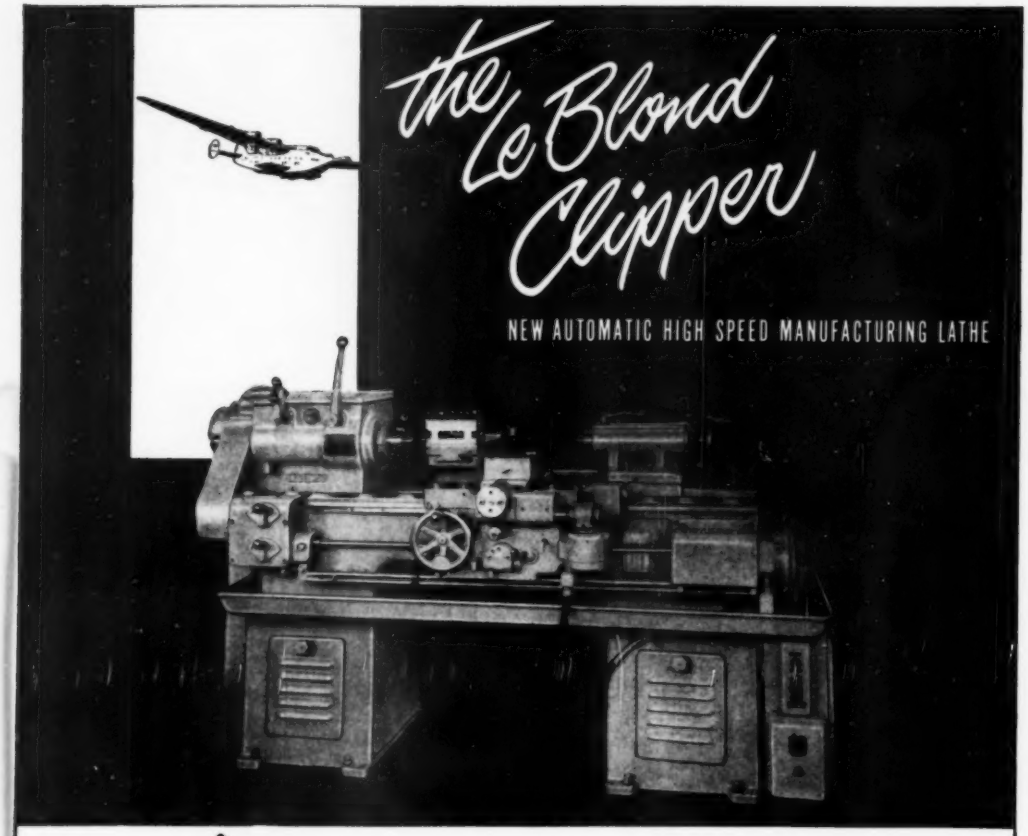
Address .....

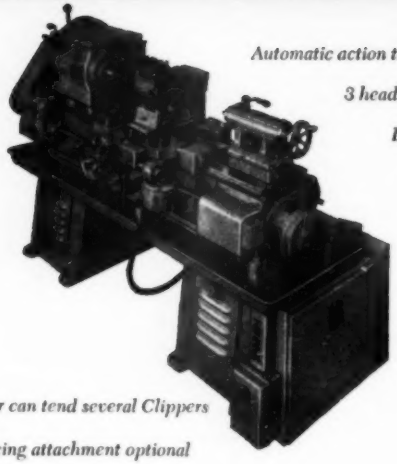
.....

GENERAL ELECTRIC

the LeBlond Clipper

NEW AUTOMATIC HIGH SPEED MANUFACTURING LATHE





Automatic action thru a complete cycle

3 headstocks to choose from

Delivers speeds up to 3600 rpm

Efficient combination of speed and power

Can be operated semi-automatically or manually

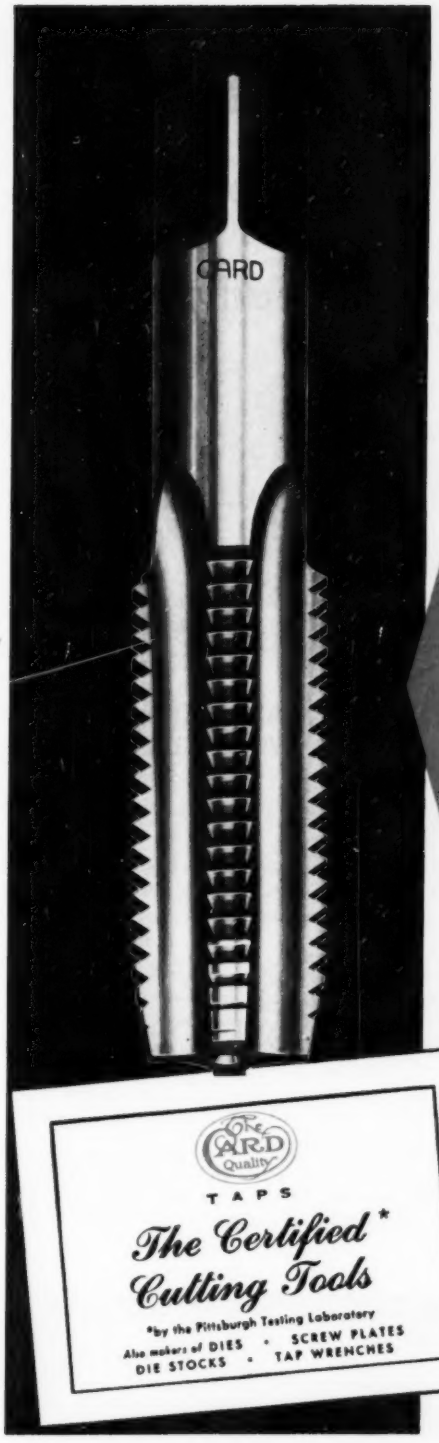
One operator can tend several Clippers

Back facing attachment optional

write for Clipper bulletin today

THE R. K. LeBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO.
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES
Sales Offices: New York, Chicago, Philadelphia, Detroit.

LEBLOND

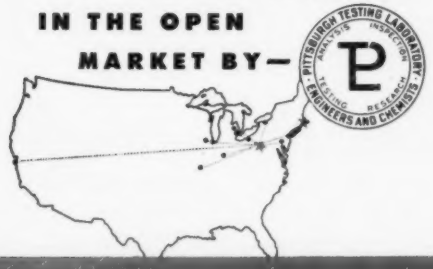


FIRST CHECK

IN CARD'S FACTORY
MANSFIELD, MASS.

DOUBLE CHECKED

BY RANDOM SAMPLE
IN THE OPEN
MARKET BY—



*Only Card Taps Are CERTIFIED**

Card's refusal to "take a chance" on quality is one big reason why metal workers rely so confidently on Card cutting tools.

Recognizing the need for a truly *objective* test of its products, Card retains the famous Pittsburgh Testing Laboratory to buy Card Taps periodically *anywhere it pleases on the open market* . . . put them through severe tests to make *absolutely certain* that they meet the highest standards. These taps are then CERTIFIED* as meeting proper specifications.

You'll find Card Certified* Taps and fast, dependable service at your nearby Card Distributor. Contact him for real savings in time and money.

S.W. CARD

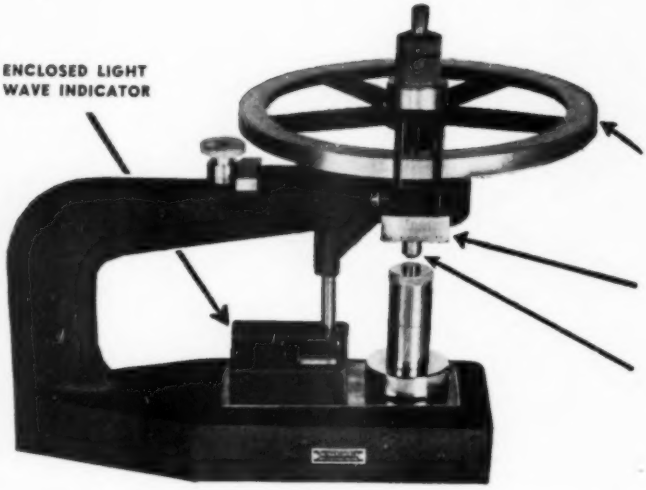
MANUFACTURING COMPANY
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL COMPANY

THE NEW

Van Keuren

0 to 3" LIGHT WAVE MICROMETER

will improve your product



CATALOG AND HANDBOOK No. 34

This 208-page volume represents 2 years research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request.

THE Van Keuren Light Wave Micrometer is an instrument of exceptional merit, proven over a period of 15 years. It has enabled hundreds of High School boys and girls to produce and inspect parts to "Hundred Thousandths" of an inch.

The New 0 to 3" Light Wave Micrometer has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel, with .0001" graduations 1/10" apart. It has a non parallax, vernier index which enables readings to be made to .00001". It has an index lock. It has carboloy tipped anvil and spindle. It is a sturdy, yet sensitive instrument which weighs 17 pounds. It is a portable measuring machine, built for "Sustained Accuracy."

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision—fast, accurate and profitable.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

30th YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

EXPERT, DEPENDABLE, CONVENIENT
Motor Repair Service

Typical Allis-Chalmers Certified Service Shop — Electric Apparatus Repair Company, Philadelphia — is equipped for big emergency jobs ... gives fast, personalized service on every day maintenance and repair.

WHEREVER your plant is located — from Boston to San Diego — you can get prompt, skillful motor repair service from a nearby Allis-Chalmers Certified Service Shop. These shops, selected for their reliability and excellent repair facilities, now cover every major industrial area in the country.

When you need work done on motors, transformers or control — when you're looking for a shop that can help you cut lost production hours and get you rolling again, fast—call the A-C Certified Service shop nearest you.

These shops are hand-picked from the best independent shops in your locality. They meet exacting A-C standards — use factory-approved methods and parts to assure like-new motor performance.

Need Repairs? New Motors?

For expert service — for new motors from ½ to 25,000 hp — give your nearest A-C Authorized Dealer or Sales Office a call!

A-2838

ALLIS-CHALMERS, 999A SO. 70 ST.
MILWAUKEE, WIS.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

20 pieces per hr. by former method
180 pieces per hr. on the BLANCHARD

Once again Blanchard Surface Grinding increases part output while slashing production costs . . . today's best formula for putting manufacturers in the black.

This time a Blanchard No. 18 with a magnetic chuck was used. A special circular fixture, of laminated construction for magnetic purposes, with 59 spring-loaded locating V's around its outer circumference was designed to hold the work. The unique design of the fixture provided for precise locating, aligning and holding of the fine grain cast iron connecting rods which had to be ground flat and at right angles to the pins — accurate finishing being essential to a later hollow milling operation of the pins.

The combination of the Blanchard's ability to remove stock more rapidly to exact tolerances and the clever holding fixture stepped up production to 180 pieces per hour as against 20 per hour by best other production method.

Here are the part details:

Length of base overall 7¼", width of base—⅞", thickness of base before grinding—7/16", overall length of pins—1¾", rough diameter of pins—⅞", finished diameter of pins—¾". Material removed 1/16" on major portion of base and two cross lugs 1/16" additional.

Send for your free copies of "Work Done on the Blanchard", third edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

New, Unique Simplicity!...

in custom-engineered

ELECTRONIC

INSPECTING

AND SORTING

EQUIPMENT

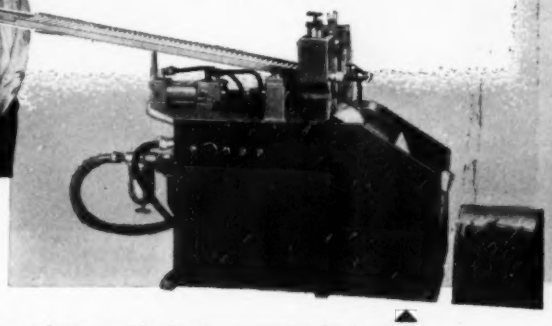
Through basic engineering developments, Brown & Sharpe custom-builds uniquely simple inspecting and sorting machines for precision parts. Machines of this description made by Brown & Sharpe have the advantages of simpler, sturdier construction; more stable adjustments; and easier manipulation of sensitivity.

This modern equipment can be designed and built to meet individual needs for:

1. *Manual loading and disposal*
2. *Manual loading and automatic disposal*
3. *Automatic loading and automatic disposal*

Why not turn over your problems of providing efficient gaging and sorting equipment to Brown & Sharpe? Send an outline of your requirements. Learn what Brown & Sharpe can offer in custom-engineered equipment. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

This single-motor, compact machine automatically gages and sorts antifriction bearing rolls. It rejects rolls above or below manufacturing tolerance and separates accepted rolls into 5 sized categories, in increments of .00002".



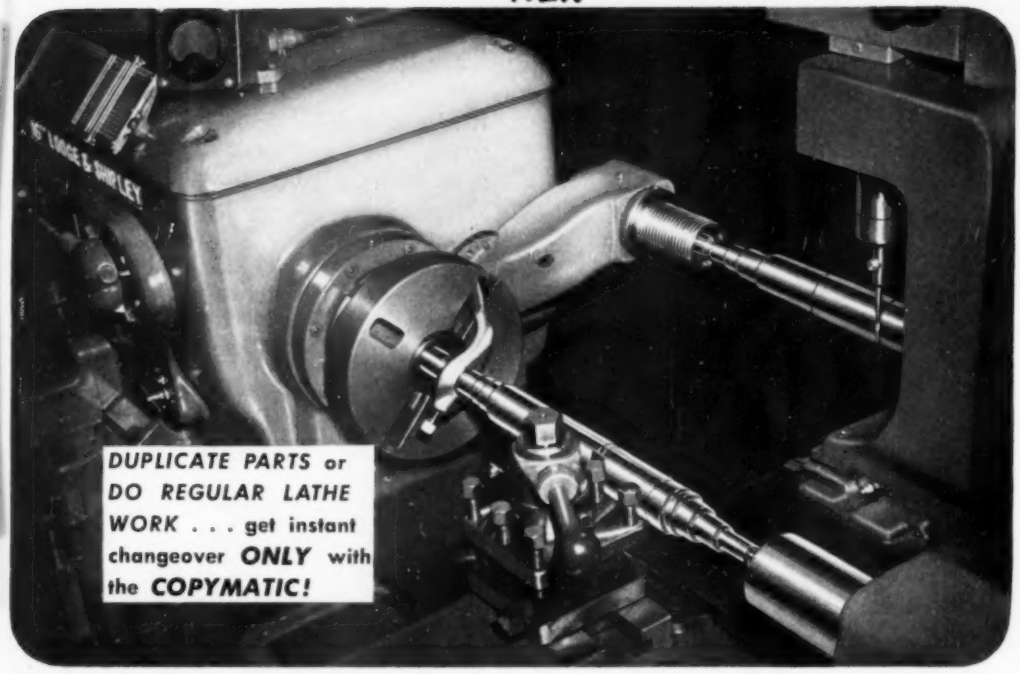
This machine gages and sorts straight sleeves—measuring for length as well as diameter at both ends. The sleeves are segregated into four categories. **1.** *Oversize and undersize in length regardless of diameter.* **2.** *Small in diameter at either or both ends.* **3.** *Large in diameter at either or both ends.* **4.** *Good sleeves within tolerance.*

The machine has a production rate of approximately 3000 per hour. The capacity is adjustable for different lengths and diameters. It is loaded manually with automatic disposal.

BROWN & SHARPE

TURNING TIME CUT 1/2

at LINK-BELT COMPANY, Philadelphia
with the *NEW* LODGE & SHIPLEY COPYMATIC Lathe



● Quickly recognized by industry, the versatility and exceptional productive capacity of the New Lodge & Shipley COPYMATIC Lathe is already serving many alert manufacturers. One of these is the Link-Belt Company, whose Philadelphia Plant reports 50% savings in machining time plus other economies . . . on the COPYMATIC. Numerous exclusive Lodge & Shipley profit features are termed "Excellent."

The illustration above shows one of "various general lathe jobs" performed on the 16 in. Model "X" COPYMATIC Lathe. A motor shaft of SAE 1040 heat-treated steel is being turned, grooved and radii finished by automatic tracer control. NOTE: *Link-Belt is using a stock shaft for the template, eliminating cost and time involved in making a special template* . . . typical of the simplicity of operation designed into the COPYMATIC.

If you're looking for more and better production . . . check the COPYMATIC. This newest development, combining the speed and convenience of automatic duplication . . . proven "Model X" efficiency . . . and instant changeover from duplication to regular lathe operation, is the talk of the shop and cost department too! Write for Bulletin No. 675.

THE **Lodge & Shipley** COMPANY
MACHINE TOOL DIVISION • 3055 COLERAIN
SPECIAL PRODUCTS DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO

50% INCREASE IN HOB LIFE

using BARBER-COLMAN

AUTOMATIC HOB SHIFTER

on No. 8-10 HOBBING MACHINE

Sixteen additional gears per hob sharpening have resulted on this Idler Gear job, since it was transferred to a Barber-Colman No. 8-10 Hobbing Machine equipped with an Automatic Hob Shifter. Previously, tool life has been only 32 gears per hob sharpening. The average now is 48 gears, or an increase of 50% in tool life.

The Automatic Hob Shifter provides uniform wear over all teeth. In addition, it reduces machine down-time, produces easier, faster cutting through sharper hobs, and retains hob accuracy longer to produce a greater number of higher quality gears.

JOB FACTS

Operation — Climb-Hob 8 Pitch Idler Gears, 49T, 2 Per Load, 6⅜" dia. x 1-1/16" face.
Material — SAE 1045 Steel, 241-285 Br.
Hobs — B-C Ground Finishing 4" x 4" x Taper bore
Feed — .053"/rev.
Speed — 150 RPM
Fl-to-Fl — 15 minutes per Gear
Tool Life — 48 gears per Hob Sharpening, 32 previous average

Ask your Barber-Colman representative to supply you with complete details on this new modern method of controlling hob wear.

Barber-Colman Company

GENERAL OFFICES AND PLANT, 1141 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

METHODS ENGINEERS
Send for a copy of this new catalog describing the Automatic Hob Shifter on the No. 8-10 Hobbing Machine. Ask for Bulletin No. 1141.

BARBER COLMAN

SHELDON

T556B
11¼" Swing
1" Collet Capacity

Accuracy is a matter of Tolerances *not Size*

There may have been a time when to be accurate a lathe had to be massive, cumbersome and expensive. That is not true today.

Accuracy is essentially a matter of tolerances not mass, and today the very finest of spindle bearings (Timkens Zero Precision Tapered Roller Bearings—run out accuracy within .00015) are found on SHELDON Precision Lathes. Beds of these 10″, 11″ and 12″ SHELDON Lathes are held to within .0005″ per foot of both parallel and longitudinal alignment while the lead screws are held within a tolerance of lead error of .0005″ in any inch. Rigidity is obtained by improved engineering—by placement of mass rather than sheer bulk.

Advances in machine tool building art, special machines, jigs and fixtures produce uniformly excellent SHELDON Precision Lathes in quantities that permit low selling prices. Larger collet capacities and increased power at the cutting point enable these more-profitable-to-operate lathes to take over much work heretofore requiring larger and more costly equipment.

Write for Catalog.

SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Milling Machines • Shapers

4234 N. KNOX AVENUE • CHICAGO 41, ILLINOIS, U. S. A.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

NEW!

Positive Low-Cost Motor Protection

These new Westinghouse Manual Motor Sentinels (motor starting and overload protection) are available in three types: the Standard (Nema type 1), the Water- and Dust-tight (Nema types 3, 4 and 5), the Explosion-proof (Nema types 7 and 9). These compact, handsomely styled switches start, stop and give positive protection to all motors up to one hp wherever they may be located.

Sensitive, automatic bimetallic element will pass momentary overloads and starting surges, but a dangerous overload will trip the switch immediately to disconnect the motor from the line and save it from damage. Examine these rugged new switches at your nearby Westinghouse distributor or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-30007

EXTRA VALUE FEATURES

POSITIVE ACTION—Bimetallic overload protection assures safe, positive action under serious overloads.

SAFE—No exposed parts. Trip-free switch (can't be held closed against an overload) with self-indicating operating handle.

TROUBLE-FREE—Over-center toggle mechanism . . . quick-make, quick-break, double-break contacts of high-grade silver for long contact life.

ACCESSIBLE—Heaters removable from the front without disturbing any wiring. Switch always remains mounted.

CONVENIENT—Switch unit fits any standard wall box. Straight-through wiring—all terminals are on the front.

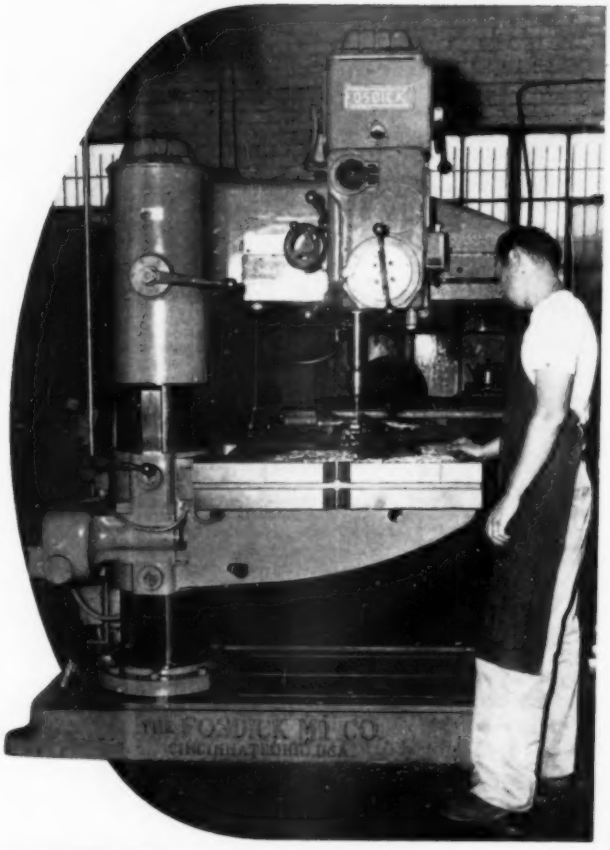
ATTRACTIVE—Sleek, hot-molded switch unit. Standard enclosure is smooth die-casting, baked enamel over Bonderizing. Watertight and explosion-proof enclosures are sturdy cast iron.

Westinghouse

MANUAL MOTOR STARTERS

A practical machine for Sensitive Drilling

FOSDICK SENSITIVE RADIAL



• Where the work is small and numerous holes are to be drilled the FOSDICK Sensitive Radial is an ideal machine. Moderately priced — it is designed to provide maximum production with the least amount of effort on the part of the operator.

For example all controls for feeds and speeds and movement of the head on the arm are centralized on the head for the convenience of the operator.

The Arm is located at a fixed height within easy reach of the operator at all times. In addition to the conventional Radial Drill Base the Machine has an adjustable table. Both the table and the arm swing in an arc of 360°.

If you have sensitive drilling operations, requiring holes up to 1½ inch diameter you should investigate the Fosdick Sensitive Radial.

Full descriptive bulletin available.
Write for Fosdick Sensitive Radial bulletin S. R. A.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

PRIMA DONNA!

You're talking turkey to truckers when you talk extra payload capacity. That's why this trailer designer sparked when he heard that a magnesium floor could eliminate 500 lbs. of dead weight. But his company had avoided magnesium . . . thought it was a "prima donna" metal, hard to fabricate. So he decided to get the facts for himself from Aluminum Company of America, light metal headquarters. He found that easy shop practices make handling magnesium no problem*... that every month industry utilizes over a million pounds of this featherweight metal . . . He got valuable books on designing and fabricating magnesium . . . plus the technical aid he needed. Now his company is putting the heat on competition with a strong, super-light trailer floor made of specially designed American Magnesium Extrusions.

The "prima donna" turned out to be a star! **No change in insurance rates.*

These two, free books on magnesium and our broad technical experience can help your products, too. Write Aluminum Company of America, sales agent for American Magnesium Products, 2107K Gulf Building, Pittsburgh 19, Pennsylvania.

MAGNESIUM MAZLO® PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

Cut...

LARGE HOLES

. . . thru any machineable material up to *ONE INCH* thick!

Here is a premium tool which makes it possible to saw holes in one short operation . . . large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

MARVEL High Speed-Edge Hole Saws come in 35 sizes, from $\frac{5}{8}$" to $4\frac{1}{2}$". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-49

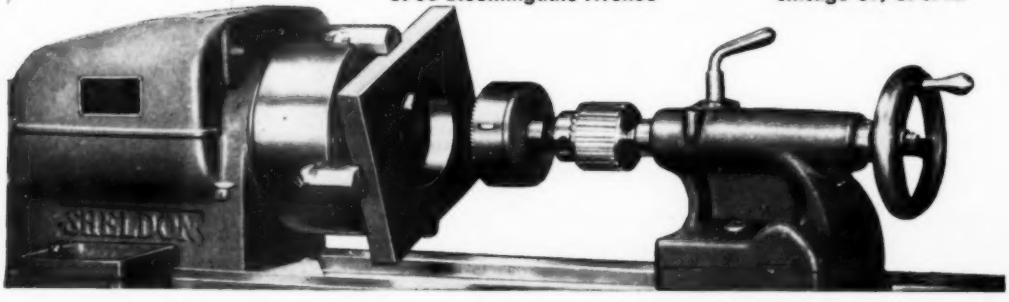
"MARVEL" *has Always had the edge!*

MARVEL *Metal Cutting* **SAWS**

ARMSTRONG-BLUM MFG. CO.

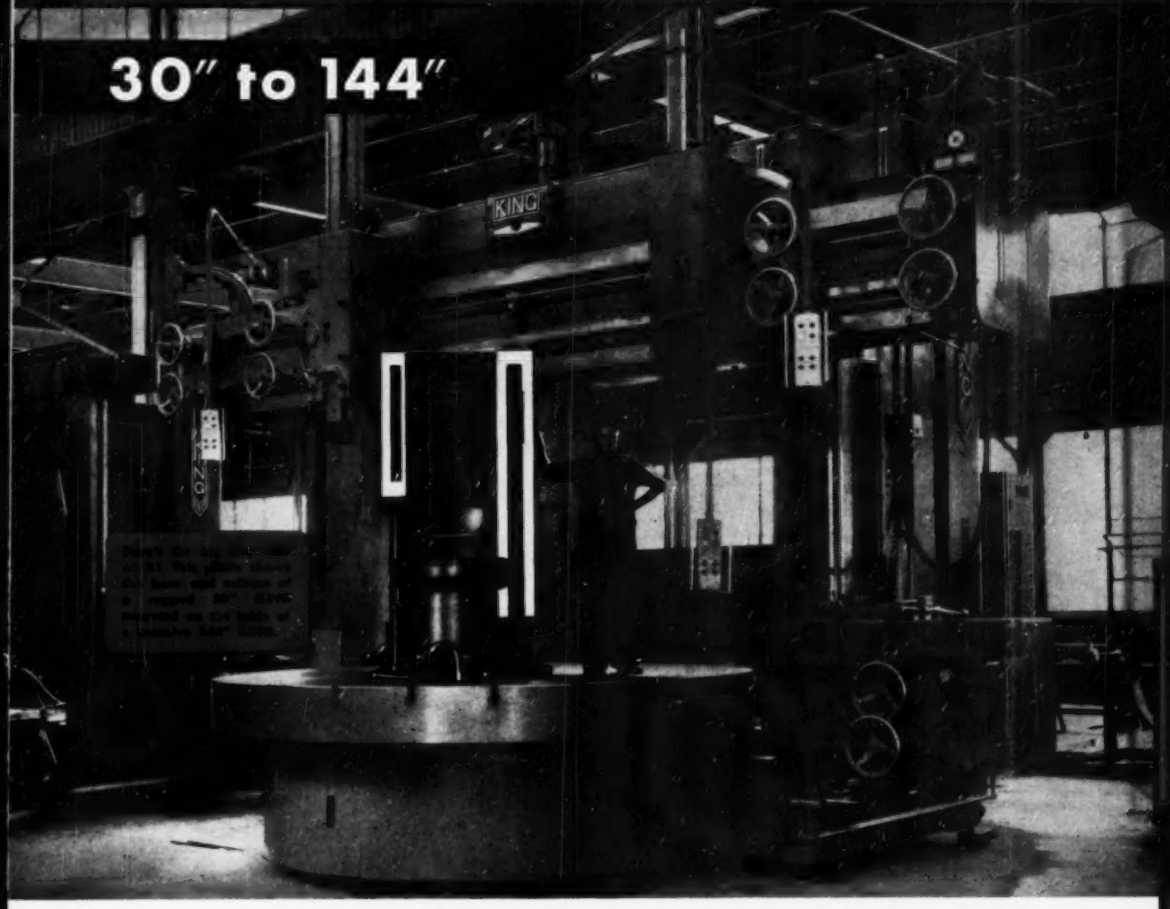
"The Hack Saw People"

5700 Bloomingdale Avenue **Chicago 39, U. S. A.**



KING Makes the Widest Range

OF VERTICAL BORING AND TURNING MACHINES



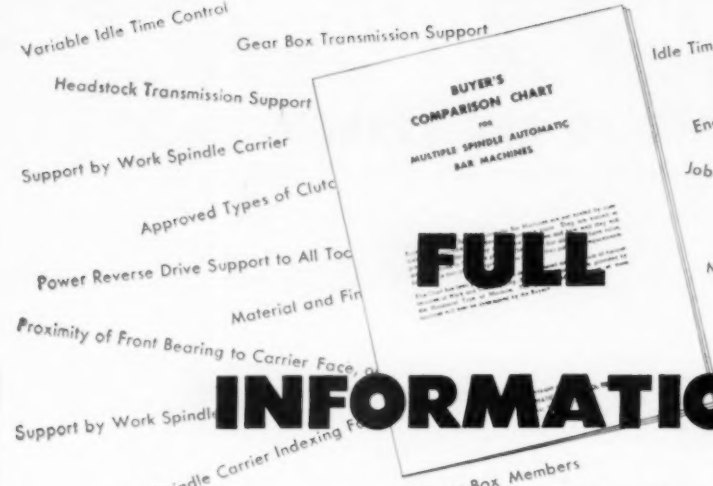
The KING line of Vertical Boring and Turning Machines is not just a "large size" or a "small size" line. It's an all size line. KING and *only* KING "covers the field", with 10 sizes: 30" and 36", one head on rail—42", 52", 62", 72", 84", 100", 120", and 144", one or two heads on rail. All sizes are available in a variety of head combinations, with or without side head.

KING has the size range—and KING has the extra weight and rigidity, the speeds, the power, the time-saving ease of control that adds up to *more work and better work at less cost.* Get the facts. Write today for catalog giving detailed information. Specify the size machines that meet your job requirements.

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes



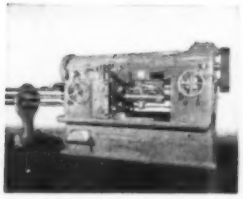
FULL INFORMATION PLEASE

Buyers of machine tools usually want ALL of the information about a machine, not just a part of it. And, with all of the information, they will give special attention to those things that have a bearing on their own particular requirements.

Case histories of machine performance in other plants clearly indicate that requirements often vary. But, for any requirement, machine performance is dependent on machine facility, and there is no better way of predetermining satisfactory quality performance than by determining a machine's quality facility.

All brands of a given type of machine offer value worthy of due consideration. A fair comparison of their facilities, in accordance with the requirements they must meet, is a logical means of establishing a preference.

For those interested in determining the facilities of multiple spindle automatic bar machines CONE has made available an analysis chart. It is designed to help guide you to ALL the information. Your copy is free. There is no obligation.



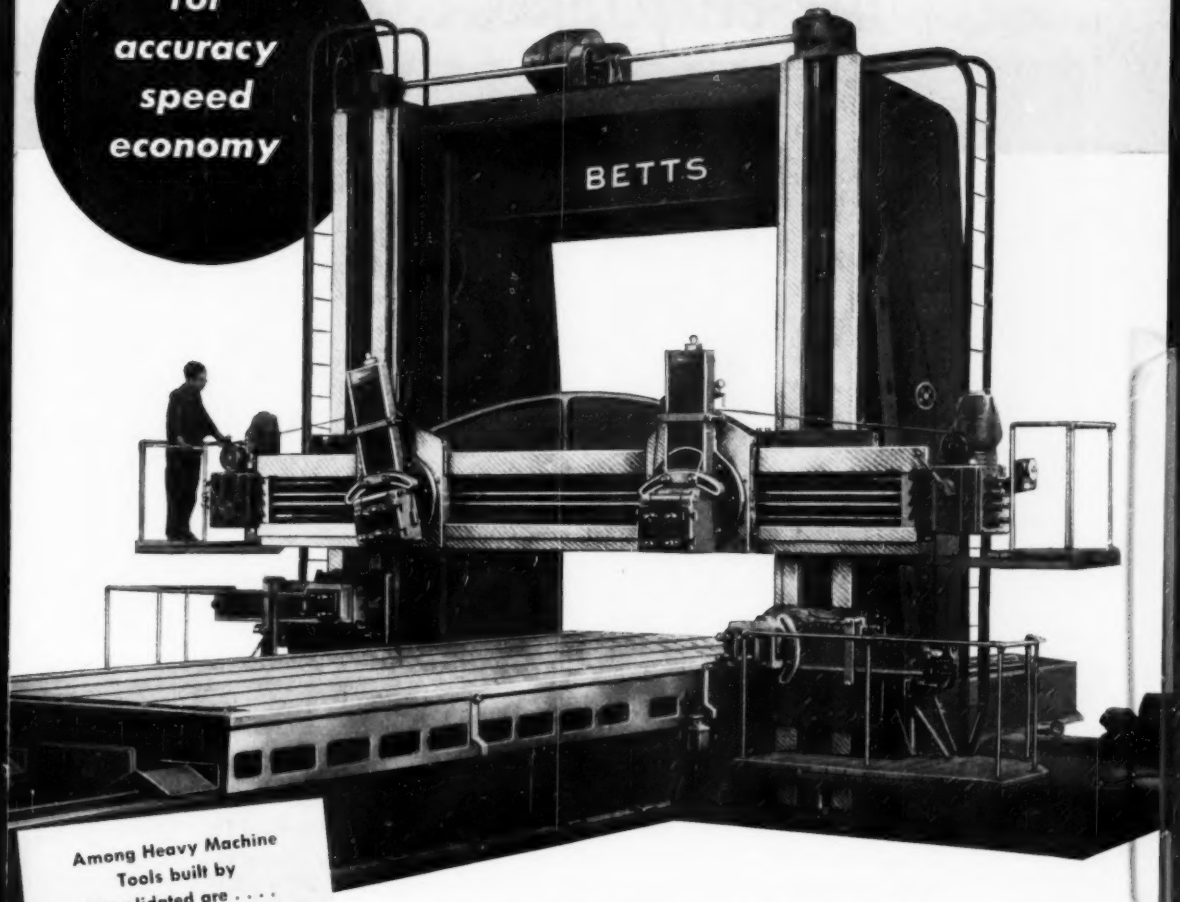
A comparison will lead you to

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

BETTS HEAVY DUTY PLANERS

for accuracy speed economy



Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

The Betts Heavy Duty Planer shown here provides 14'-0" between uprights, 11'-6" under tools and 28'-0" stroke. It is designed with three bed ways for even load distribution when machining especially heavy work. Variable voltage planer drive provides smooth, accurate operation in a wide speed range. Built in a range of sizes up to any requirement. All Betts Planers are soundly engineered to insure long, dependable service combined with operational economy, safety and convenience.

Complete information will be furnished upon request

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

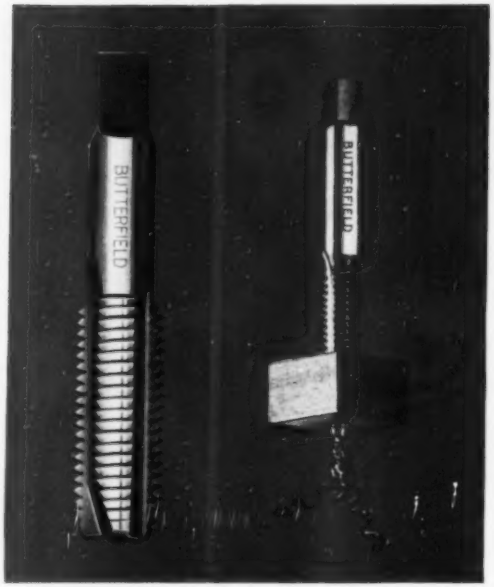
BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

Let the chips fall either way!



CHIPS CURL DOWN and out of deep through holes when you use Butterfield Ground Thread Spiral Pointed Taps — right hand cut, left hand spiral points. No chip clogging in the flutes. These taps also recommended for blind holes when drilled deeply enough to allow clearance for chips at bottom of hole.

CHIPS SPIRAL UP and out of blind holes that have little or no chip room at the bottom when you use Butterfield Ground Thread Spiral Fluted Taps — right hand cut, right hand spiral flutes. Flutes are milled to the correct degree of spiral allowing tap to cut freely while ejecting chips from hole.

INSIST ON BUTTERFIELD GROUND THREAD TAPS

Whether you want to tap blind holes or through holes, there's a Butterfield Tap to meet your need . . . to cut smooth, accurate threads in aluminum, magnesium, brass, copper, zinc and similar materials. What's more, because they're *Butterfield*, you get extra assurance of top performance, maximum savings in time and money. *Every Butterfield Tap is individually inspected.* These taps, too, are *ground thread*...providing maximum accuracy and savings by fewer wasted threaded parts.

For quick deliveries, depend on your nearby Butterfield Distributor. Union Twist Drill Company, BUTTERFIELD DIVISION, Derby Line, Vermont and Rock Island, Quebec.

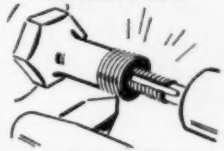
BUTTERFIELD

THE 100% INSPECTED TOOLS

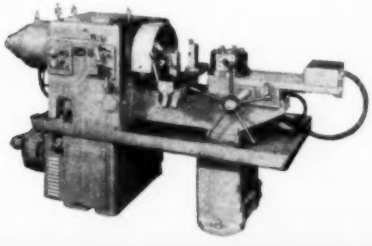
Every Tool Individually Inspected

TAPS • DIES • REAMERS • SCREW PLATES

EVER MAKE THIS COMPARISON?

JOB	CUTTING TIME	HANDLING TIME	PRODUCTION
Here's a typical brass shop job 1 piece is made every 20 seconds	Actual cutting time consumes 20%  ...or 4 seconds on each piece	Machine handling consumes 80% ...or 16 seconds on each piece	***180 pieces per hour***
Same job, but...	you ***reduce*** cutting time 50%... Saving 2 seconds on each piece	but ***don't reduce*** handling time... Still 16 Seconds on each piece	***200 pieces per hour*** ***Up 20 pieces per hour*** ***11% increase***
Same job, but...	you ***don't reduce*** cutting time... Still 4 seconds on each piece	but ***do reduce*** handling time 50%... or 8 seconds on each piece	***300 pieces per hour*** ***Up 120 pieces per hour*** ***66% increase***

DESIGNED EXPRESSLY to reduce machine handling and work handling time, Warner & Swasey Electro-Cycles have a place in *your* shop. Find out how automatically controlled spindle speeds, start, stop, reverse, and spindle positioning can reduce manual effort, make work easier for operators, and up production to cut your costs. Call your nearest Warner & Swasey office now—or write.

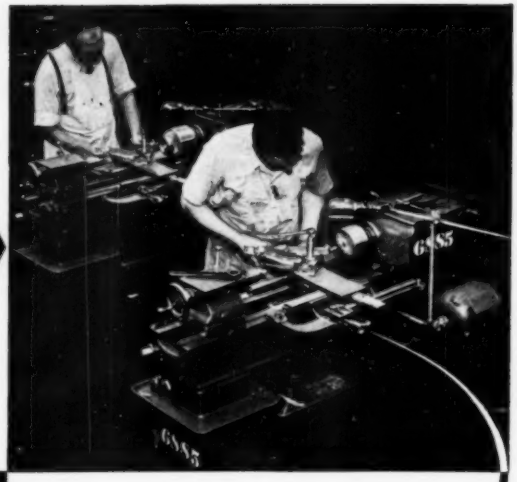


You can machine it Better, Faster, for Less... with a Warner & Swasey

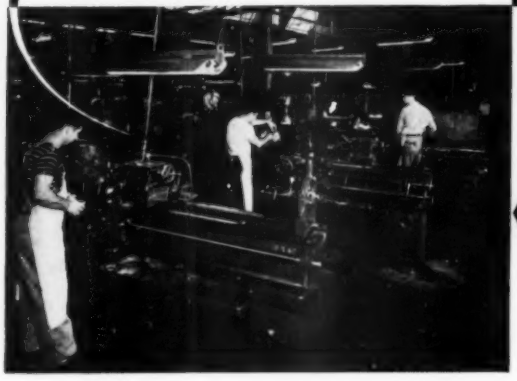
WARNER & SWASEY Machine Tools *Cleveland*

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

from Connecticut

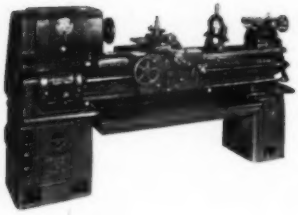


Two 10" Tray-Top Cintilathes in use in the shop at Pratt & Whitney Aircraft, West Hartford, Conn.



Three Tray-Top Cintilathes in service at Wells Aircraft Parts Company, Los Angeles, Calif.

to California



Wells Aircraft bought its first Tray-Top a year ago and after six months ordered two more. Mr. Elmer Wells writes: "... Our work is of an experimental nature or short run jobs on aircraft which demand high grade finishes, close tolerances and trustworthy lathe alignments ... We believe the **Ground Ways** are an important factor in producing accurate work ... Our operators find the 1200 rpm and twelve speeds to be a decided advantage, particularly in changing from steel to aluminum parts of varying sizes and diameters ... The enclosed **Quick Change Gear Box** is a good feature, it eliminates chips from clogging the gears."

Before you buy your next light duty engine lathe, examine the sound practical features of Tray-Top Cintilathes. Add them up and you'll find the "Twenty-Feature" Tray-Top Cintilathe gives you the most utility for the least investment. Swing sizes: 10", 12½", 15", and 18". 15" and 18" sizes available with gap and gap block. Write for Bulletin T-100-2. Cincinnati Lathe & Tool Co., Cincinnati 9, Ohio.

cintilathe

TWENTY-FEATURE TRAY-TOP

BARDONS & OLIVER, Inc. ANNOUNCES

A BRAND NEW ROLLER CUTTER TYPE PIPE NIPPLE MACHINE . . . chamfers both ends for threading and cuts off—up to 100 OR MORE NIPPLES PER MINUTE!

. . . why consider a 4 to 8 spindle machine when this SIMPLE and INEXPENSIVE single-spindle machine will produce as many pieces or even more?

DEVELOPED SPECIFICALLY FOR *Highest Production of Pipe Nipples*—

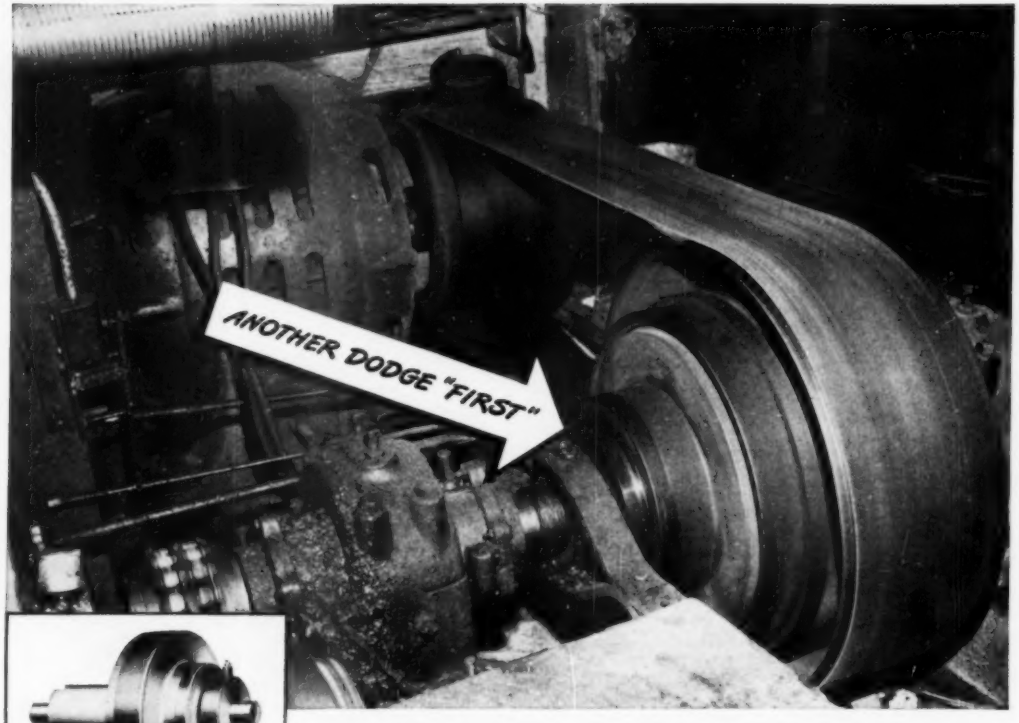
"Also highly productive for many similar parts made from pipe or tubing."

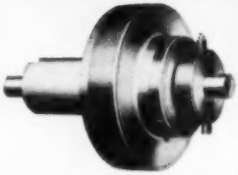
COMBINES ALL OUTSTANDING ADVANTAGES OF BOTH THE ROLLER CUTTING PRINCIPLE AND ALSO THE POWER DRIVEN REVOLVING SPINDLE IN A SINGLE MACHINE

1. Roller Cutter eliminates all cutting waste, thus producing the maximum number of Nipples from a given length of pipe.
2. Power Driven Revolving Spindle lengthens Roller Cutter life, producing 5,000 to 10,000 or more Nipples before resharpening is necessary.
3. Overall lengths of Nipples are consistently held within tolerance of a few thousandths of an inch, without any slowdown in production.
4. Cut off and chamfered ends of nipples are accurate and true running, with smooth finish.

For Further Information, Please Consult

BARDONS & OLIVER, INC. 1133 WEST 9TH STREET CLEVELAND 13, OHIO





Over 50 years of experience in the manufacture of industrial clutches have gone into the development of the famous Dodge Diamond D Friction Clutch – noted for its ruggedness and simple, one-point adjustment.

"SHOCK" TROUBLE?

Here's one way to lick it!

HERE A Dodge Diamond D Clutch takes the tremendous shock loads of a veneer peeler lathe. Huge logs are revolved and "peeled" by knives, with 150 to 200 engagements per hour! Precision-built clutches, capable of performing dependably where profits depend upon uninterrupted operation, are another Dodge "first"—one of many Dodge "firsts" in the field of power transmission machinery.

For information on how Dodge products can improve machine performance, save power and keep production steady, call the Transmissioneer, your local Dodge Distributor. He has information on new and better developments for the mechanical transmission of power.

DODGE MANUFACTURING CORPORATION • MISHAWAKA, INDIANA

TAPER-LOCK SHEAVE
Simplest, surest mechanism ever devised for holding wheels to shafts.

DODGE-TIMKEN BEARINGS
save power on millions of industry's toughest jobs.

ROLLING GRIP CLUTCH
No toggles! Compact. Extreme flexibility with positive drive.

TAPER-LOCK FLEXIBLE COUPLING
Available from stock ready to install *without reboring!*

FIRST IN POWER TRANSMISSION MACHINERY!

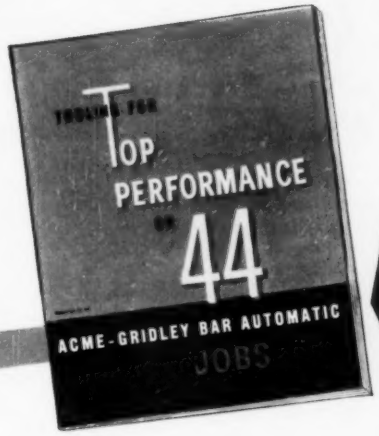
DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER
– graduate of a Dodge factory course, qualified to help on your power transmission problems. Look for his name under "Power Transmission Equipment" in your classified telephone book

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

Every Producer of Bar Machine Parts Can Profit From—



THIS NEW BOOK

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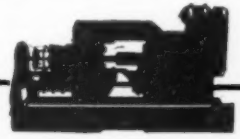


ACME-GRIDLEY BAR AUTOMATICS built in 4, 6 and 8 spindle styles, maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.

Here's how you can use this factual record of 44 authentic case studies—pointing the way to the savings to be made with up-to-date Acme-Gridley Multiple Spindle Bar Automatics:

1. As a guide in planning plant expansion programs. The successful machining methods shown will aid in the selection of equipment most economically suited to quantity output of new items.
2. As a basis of comparison in making recommendations for disposal of obsolete or less profitable machines. The production possibilities indicated will point the way to selection of new equipment that can effect lower production costs with fewer machines.
3. As a means of reducing machining costs with your present Acme-Gridleys, through adoption of the modern tooling methods illustrated.

You'll find this new book crammed with usable facts—not meaningless generalities. You'll find it profusely illustrated and easily understandable. All performance studies are grouped by class of operation, for ready reference. (See table of contents at left.) This is the most complete, most usable, *most valuable* book of its kind ever offered. Be sure to write us for your copy. Ask for Bulletin TP-44.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

This 3.35 lbs. per ft. is out

- **You don't buy it**
- **You don't machine it**

You can see where the use of Disston Special Hot Rolled Shapes saves production costs and material. These basic savings are stepped up by Disston ability to give you uniform accuracy in all dimensions and remarkably clean finish.

Do you run into difficulty on any hot rolled shapes you use now? Disston skill and facilities will come to your rescue.

What new special shapes will be practical for you? Disston will work them out to save you time and money right from the start.

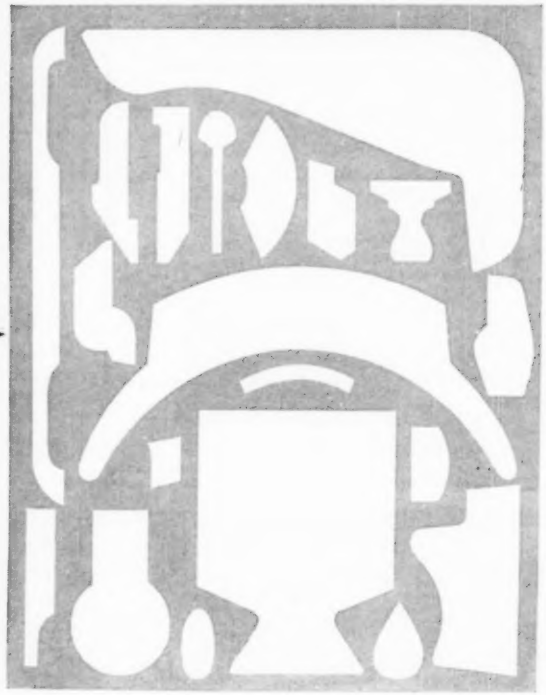
You can effect distinct economies with special shapes in electric, open hearth and Bessemer grades, hot rolled by Disston.

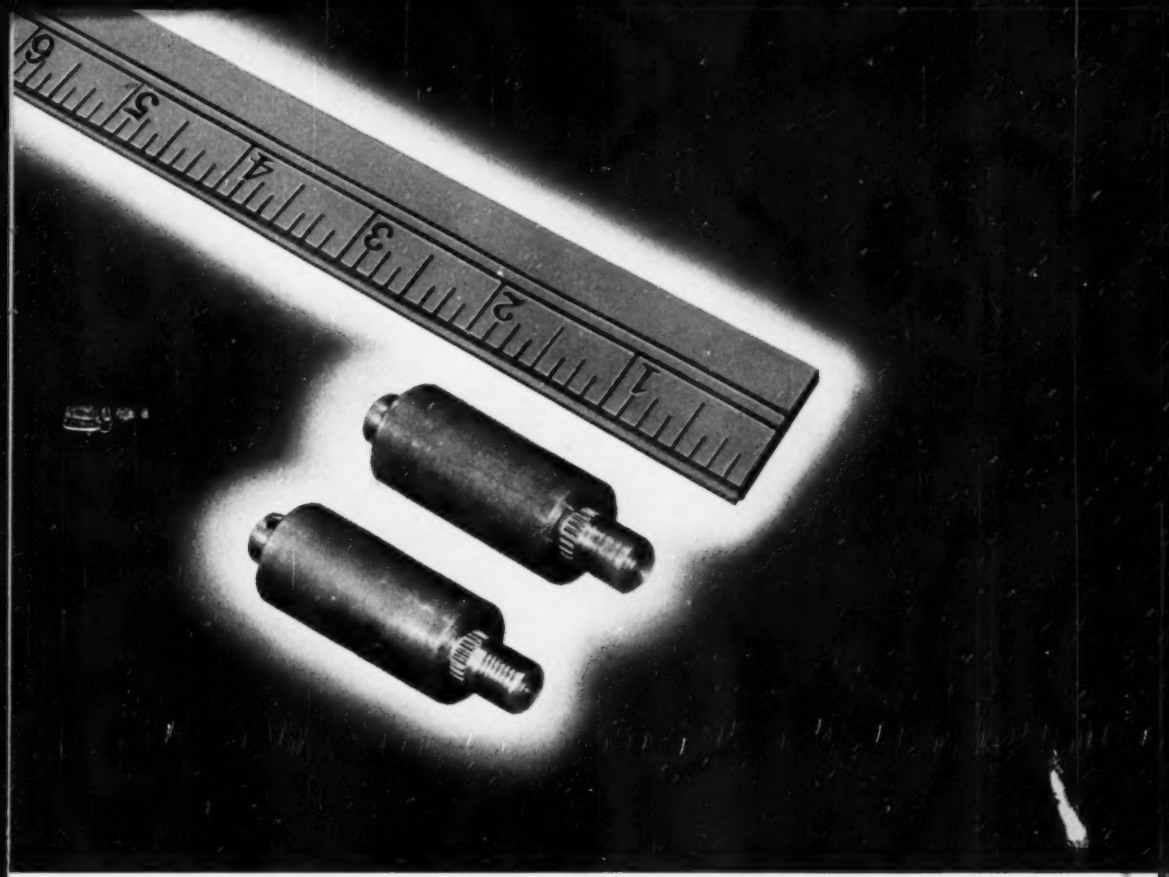
A few of the many Disston Special Hot Rolled Shapes are shown below, full size.

DISSTON HOT ROLLED SHAPES

WHEN YOU BUY A DISSTON PRODUCT YOU BUY DISSTON STEEL SKILL and SERVICE

HENRY DISSTON & SONS, INC., 1829 Tacony, Philadelphia 35, Pa., U. S. A.





Steps up output on automatics . . .

THE PARTS shown above are produced and used by a Michigan company in the manufacture of lawn mowers. The parts are made from ¾-inch bar stock of 1030 steel on a Cleveland single-spindle automatic. To make these lawn mower axles, the operations required are forming, knurling, threading, and cut-off.

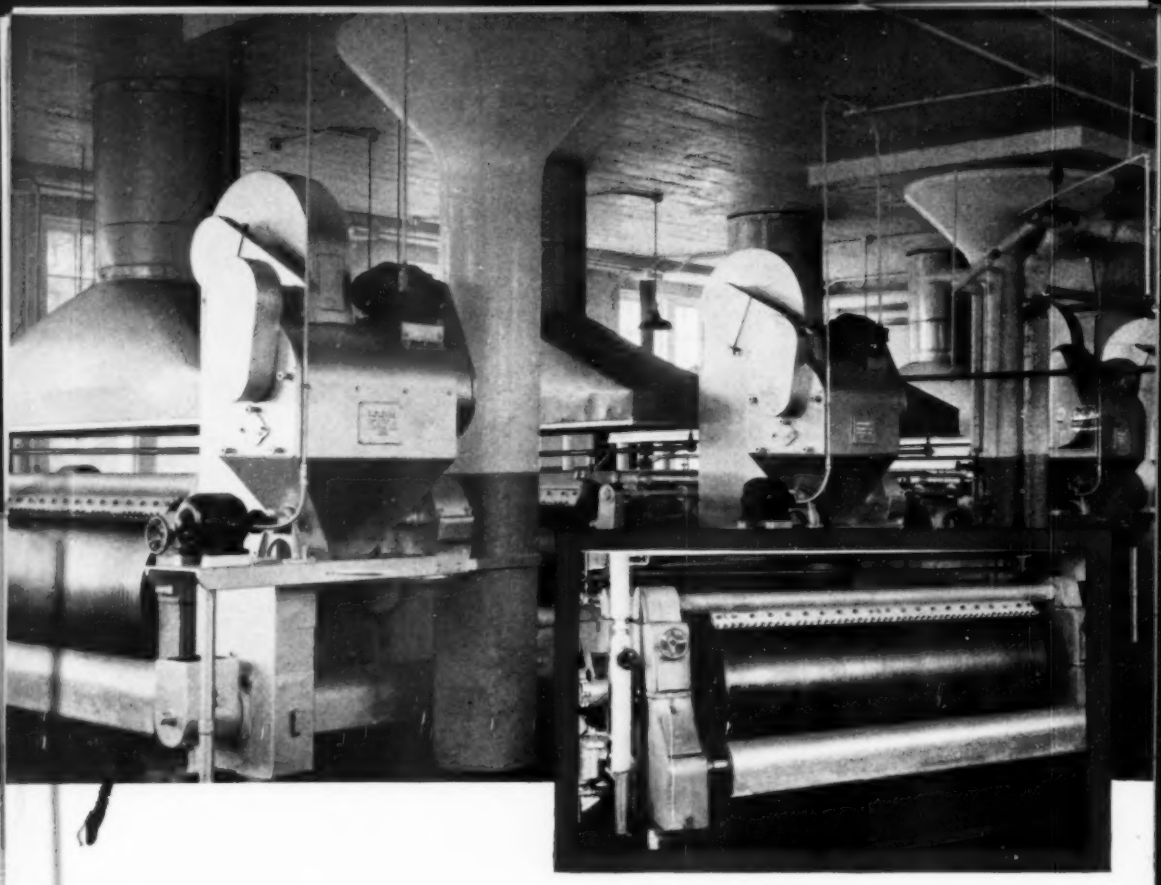
In order to maintain a daily output of 500 to 600 lawn mowers, a high production rate was required on these parts. Various cutting oils were tried in an attempt to reduce tool wear and step up production. One product—Stanicut 137 BCS Cutting Oil—brought results that far exceeded those of the other oils. It increased tool life 30% over the best of previous results.

Stanicut Cutting Oils are effectively compounded to help your tools and machines handle the most difficult machining operations. To get the best possible tool life, accuracy, and finish on jobs involving soft metals or hard alloys, try these superior cutting oils. A Standard Oil Cutting Oil Engineer will help you choose the right oil for the job.

Stanicut 137 BCS Cutting Oil

If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD



LOW upkeep despite HIGH temperatures

● Gears and bearings on the hot rolls of the milk-drying machines shown above operate at temperatures around 250°F. Proper lubrication requires an oil that will withstand oxidation and excessive thinning at these high temperatures.

On this job, Stanoil Industrial Oil has fully met the severe lubrication requirements. *During the ten years Stanoil has been used, no lubricated part of the dryer rolls has needed repair or replacement.* Gear cases have remained free of sludge. While the oil has been changed each year as a matter of operating routine, Stanoil has shown practically no deterioration in service.

STANOIL
Industrial Oil

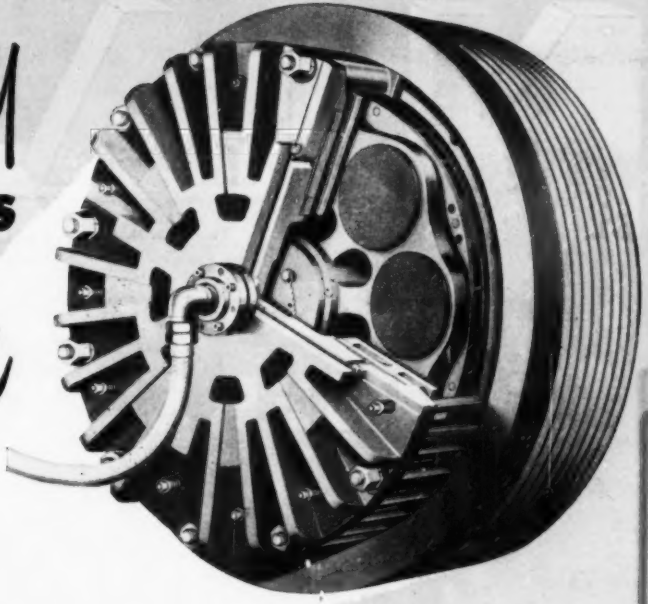
Stanoil can handle many difficult jobs for which special products are often thought necessary. It provides clean and dependable operation in speed reducers, hydraulic units, and a wide variety of circulating systems. It owes this versatility to effective oxidation-resistant and anti-foam additives combined with the highest quality solvent-extracted base stocks.

Why not find how Stanoil can save you the cost of special oils and simplify stocking problems? A Standard Oil Lubrication Engineer will be glad to help you.

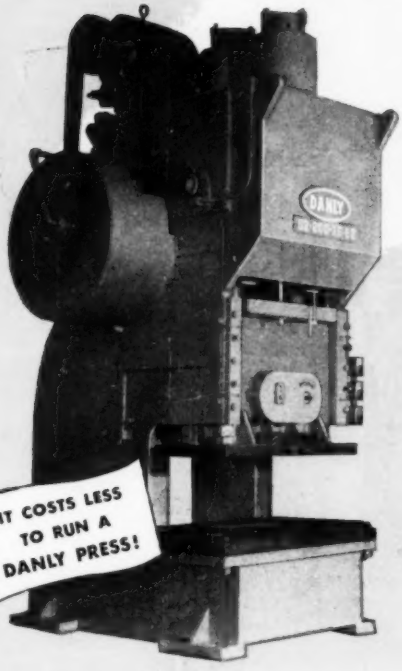
Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD

Here's why DANLY PRESSES run longer



This cutaway view of the new, cool-running Danly Clutch shows how the friction discs are held in place by their retaining "spider."



THE NEW COOL-RUNNING DANLY CLUTCH OUTWEARS CONVENTIONAL CLUTCHES 7 TO 1!

...and greatly reduces the largest single item of press operating costs, clutch maintenance. The cool-running Danly clutch overcomes heat... major cause of clutch wear... by reducing clutch "pick up" load 80%. High velocity air cooling of all internal parts produces a still further reduction in operating temperature so that a Danly Clutch in continuous operation runs only 35° above room temperature. Actual tests under normal operating conditions resulted in only .006" of friction surface wear for 100,000 engagements in a Danly clutch against .043" of wear in a conventional type clutch.

And complete renewal of friction material takes less than 30 minutes! Only quick replacement of special friction discs in an easily accessible spider is required. No riveting, fitting or extensive disassembly is necessary.

Other outstanding features include positive pressure lubrication throughout, completely stress relieved frame weldments, and sensitive control reaction. All of these outstanding Danly Press advantages are certain to reduce overall operating costs, through labor savings and longer die life.

Send for this free booklet on the new Danly AUTOFEED Presses today and see how these outstanding features save money on high production stamping runs.

DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS

DANLY MECHANICAL PRESSES...50 TO 3000 TONS

DANLY

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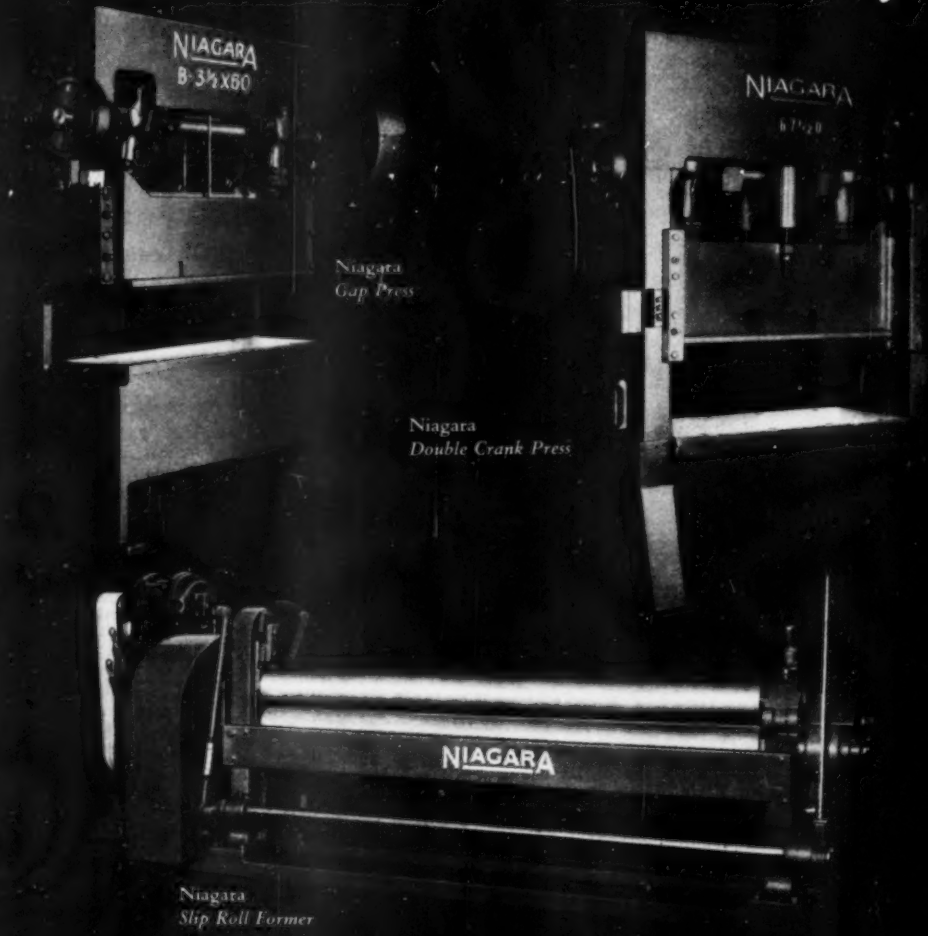
NIAGARA

PRESSES, SHEARS, TINNERS TOOLS *for*



Niagara
Gap Press

Niagara
Double Crank Press

Niagara
Slip Roll Former

NIAGARA MACHINE AND TOOL WORKS, BUFFALO 11, N.Y.

RA MACHINES *and* SHEET METAL WORK

Operations including shearing, blanking, punching, forming, flanging, beading, corrugating, seaming and many others are being done quickly, economically and accurately on Niagara machines. Niagara machines and tinners' tools on these pages are just a few of the hundreds of types, sizes and capacities which make Niagara America's most complete line. Write for helpful bulletins.

Niagara
Ring and Circle Shear

Niagara
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Niagara
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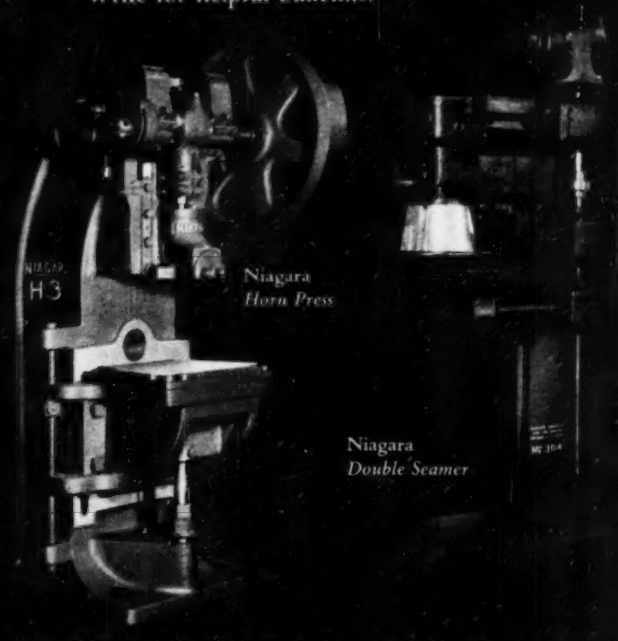
Niagara
Foot Gap Shear

Niagara
Snips

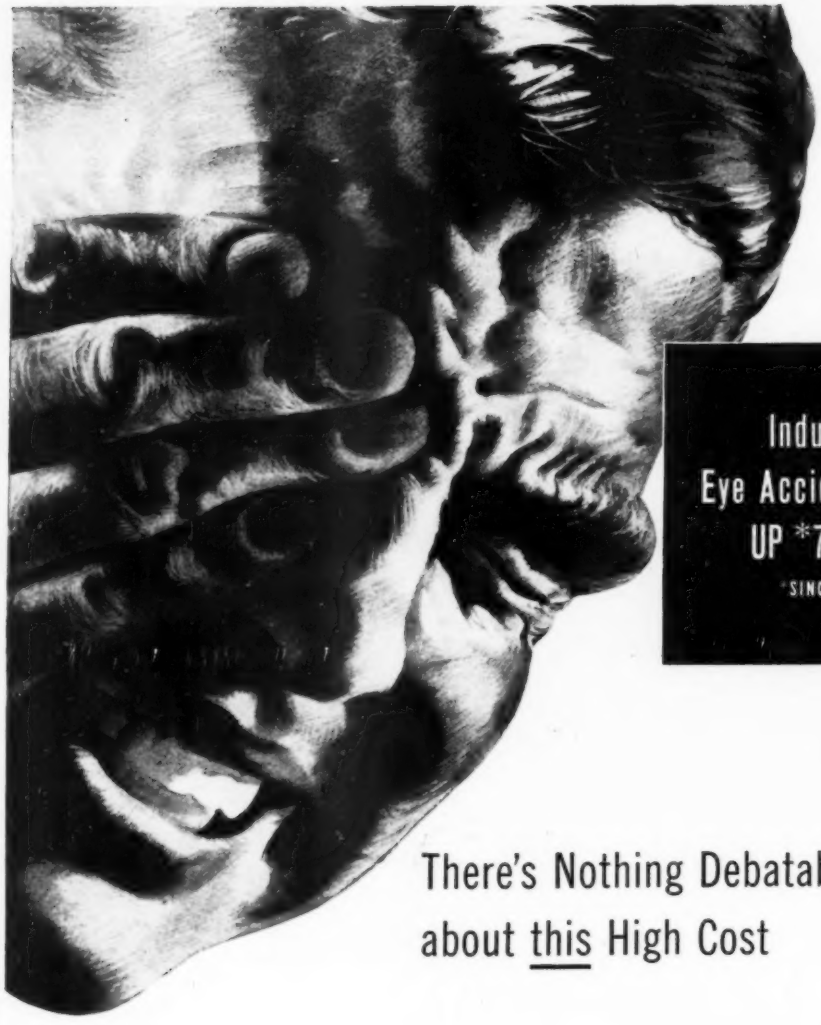
● Niagara Electric Combination Machine for burring, turning, wiring, beading, crimping, elbow edging, slitting and other operations.



Niagara
Horn Press

Niagara
Double Seamer

District Offices: Detroit, Cleveland, New York



Industrial
Eye Accident Costs
UP *78½%
*SINCE 1939

There's Nothing Debatable
about this High Cost

...it can be cut!!

Many high costs are "sacred cows" that resist correction, but high eye accident costs have *no sponsor!* They can be cut now—and the savings may be amazing. A goggle costing $2.30, approximately, has saved claims in four figures, has kept a skilled operator (instead of a substitute) on the job, has kept output up, rejects down.

The facts about an adequate eye protection program that can prevent 98%* of all eye injuries, are yours for the asking. An AO Safety Products Representative will be glad to call without obligation on your part. He's near you—call him today.

*98% of industrial eye accidents are preventable when shop workers wear safety goggles according to the Society for the Prevention of Blindness.

American Optical
COMPANY
SAFETY PRODUCTS DIVISION

Southbridge, Massachusetts • Branches in Principal Cities

CIMCOOL

covers— 85% of all metal cutting operations

Puzzled by too many cutting fluids?

The problem is easily solved when you switch to Cimcool°—the revolutionary cutting fluid that covers 85% of all metal cutting operations. Cimcool replaces all water emulsions and all but a few highly compounded specialty oils.

And it does a *better* job.

How is Cimcool different from old-fashioned cutting fluids? It's a *chemical emulsion* that combines friction reduction and cooling capacity in a degree never before attained. It increases tool life—reduces down time. And Cimcool permits faster speeds—cuts cost of cleaning and changing, for it lasts longer in the machine. Let Cimcool prove itself in your shop.

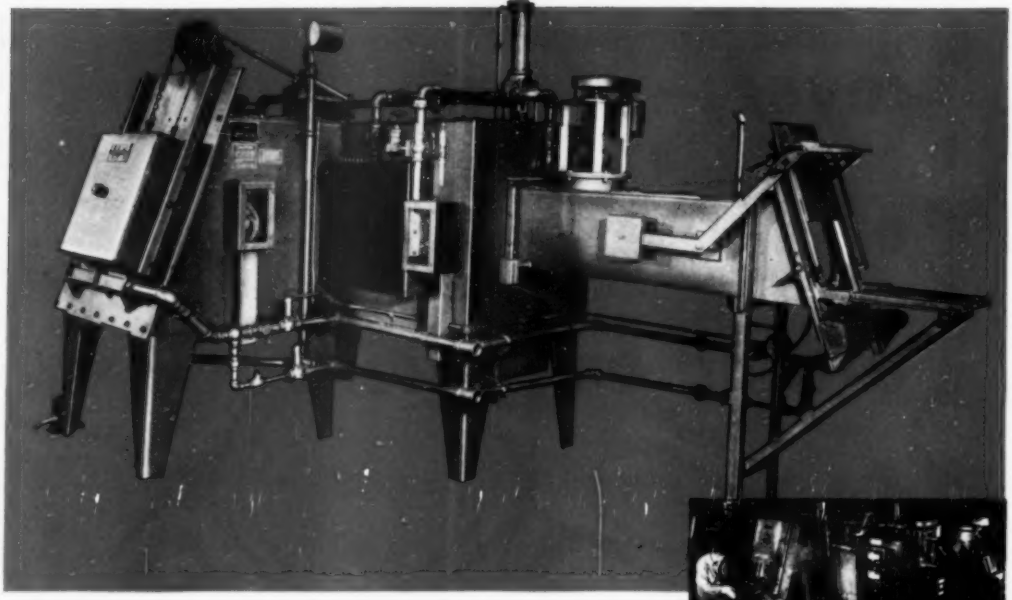
Write for free booklet, "CIMCOOL Gives the Answers." Address, Sales Manager CIMCOOL Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for 85% OF ALL METAL CUTTING JOBS

Announcing a new process for heat treating High-Speed Steels!



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THE LINDBERG "L-TYPE" FURNACE

This revolutionary new furnace is designed to harden precision high-speed tools completely scale free and without discoloration. It is ideal for tools with fine cutting edges that cannot be ground or cleaned after hardening.

Unique in construction and appearance—preheat, high heat and quench are combined in one unit—designed for complete atmosphere protection from start to finish. The "L-Type" Furnace is the result of three years of research and a year and a half of testing in the Lindberg Commercial Heat Treating Plants. It is the FIRST MAJOR ADVANCE in hardening high-speed steels since the introduction of atmosphere treating.

COMPLETELY ELIMINATES

- . . . cracking of tools due to quenching strains
- . . . removing scale by sandblasting or grinding
- . . . drastic dimensional changes during processing
- . . . oil quench tank and oil cooling system
- . . . washing quench oil from work
- . . . decarburization and carburization troubles

OFFERS MANY ADVANTAGES

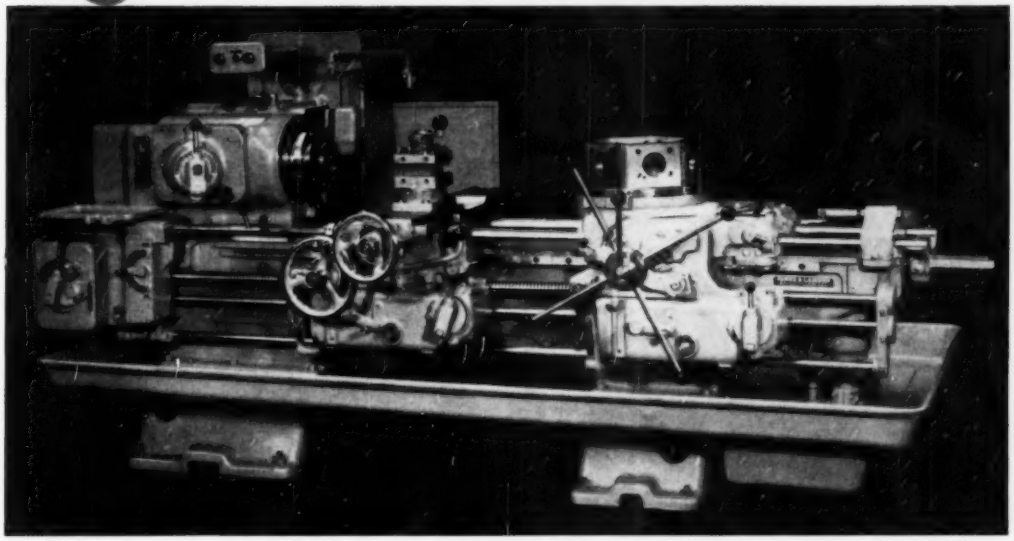
Improved surface appearance . . . Increased tool life . . . Decreased heating costs . . . Decreased atmosphere costs . . . Improved working conditions . . . Not limited to high speed steels.

Write for Bulletin No. 220 for full details.

LINDBERG ENGINEERING COMPANY 2445 W. Hubbard Street, Chicago 12, Illinois

LINDBERG **FURNACES**

Over 4½ Tons of High Powered Precision!



NEW JONES & LAMSON SADDLE TYPE 7A UNIVERSAL TURRET LATHE

2½" Bar or 12" Chuck

Rugged, Functional Design, Heavy, Deep, Rigid Bed Gives New Production Efficiency

Full Length Lead Screw:

- *Carriage and Saddle Threading to Full Turning Length*
- *Wide-Range, Single Lever Thread Selector*
- *All-Sliding Gear Quick-Change Gear Box*
- *Automatic Safety Interlocks on Threading Controls*

- Power Rapid Traverse for Cross Slide and Saddle—Power Indexing Turret
- Lower, Wider Chip Pan with Centrifugal Coolant Pump
- 12 Spindle Speeds with 20 Horsepower Constant Speed Motor
- All Tooling Interchangeable with Previous 7A Models

— ***PLUS*** all the famous Jones & Lamson characteristics of easy operation, versatility and repetitive accuracy!

Built & Powered to Produce *MORE chips per tool, MORE pieces per hour, MORE profit per job*—than any turret lathe of comparable size!

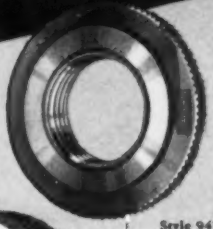
Turret Lathe Division **JONES & LAMSON** MACHINE COMPANY
Springfield, Vermont, U.S.A.

MACHINE TOOL CRAFTSMEN SINCE 1835

✓ *Write to Dept. 710 for Complete Information*

For More Measurements Per Gage Dollar

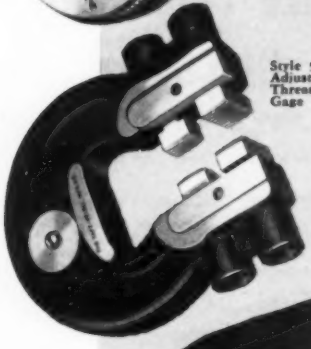
Style 9416—Thread Plug Gage
TAFT-PEIRCE MFG. CO.
Style 9410-R—Reversible Thread Plug Gage, Go and Not-Go
Style 9410—Taper Lock Thread Plug Gage, Go and Not-Go
Style 9474—Pipe Plug Gage



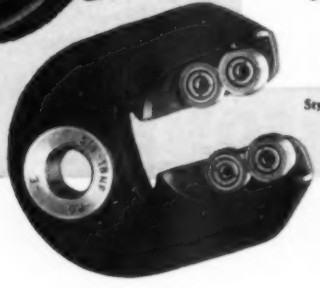
Style 9431—Thread Setting Blocks

Style 9475—Pipe Ring Gage

Style 9424—Thread Ring Gage



Style 9432—Adjustable Thread Snap Gage



Style 9435—Johnsons Roll Thread Snap Gage

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TAFT-PEIRCE Thread Gages

These Taft-Peirce thread gages are built to give you longer gage life. Made of the finest materials, this complete line is produced with the accumulated skill of one of the world's most experienced manufacturers of gages. Delivery of standard sizes can be made immediately from stock; prompt shipment can be expected on made-to-order specials.

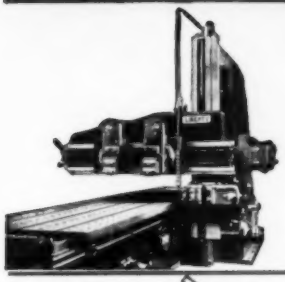
For quotations, price lists, literature, 'phone your nearest Taft-Peirce representative or write—

The TAFT-PEIRCE Manufacturing Company
WOONSOCKET, R. I.

T-P means TOP PRECISION

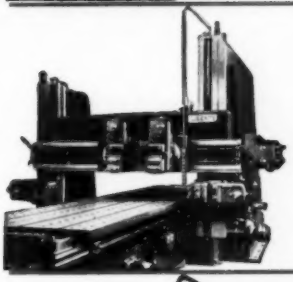
LIBERTY

BUILDS 3 *great* PLANERS



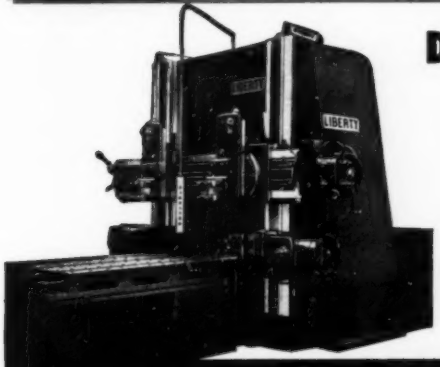
OPEN SIDE

For shops handling work of variable widths. Wide-faced housing and motorized clamp give rigidity for heavy roughing cuts and finishing. Dual control; electric feeds; rapid traverse to all Heads in all directions.



CONVERTIBLE

For exceptional rigidity on variable widths. Two, three or four heads. Offset heads permit closest approach of tools. Double balanced driving gear and pinions. Extreme accuracy.



DOUBLE HOUSING

For rapid production combined with accuracy. Two, three or four heads. Extremely rigid; handles production work with maximum cutting feeds and speeds. Table pulled into tool. Electric clamping and dual control for ease of operation; high production.

Write for catalog giving complete details.

All lengths, 24″ x 24″ wide and larger.

LIBERTY PLANERS, INC.

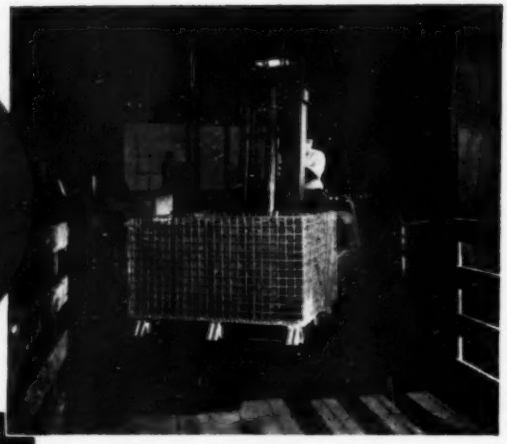
HAMILTON, OHIO

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 W. MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities

Pittsburgh CARGOTAINERS

Speed Operations and Reduce Handling Costs



Above, CARGOTAINER being loaded into delivery truck at vendors holds 345 castings—more than 2700 lbs. Previously only 88 castings weighing 704 lbs. were handled in odd size drums by one man in the same amount of time. Uniform size of CARGOTAINERS allows easy stacking after castings are loaded—also affords more efficient handling from inspection through shipping.

CARGOTAINERS in above photograph are received at assembly plant from vendor—are easily unloaded directly from truck to storage space. Note ease of stacking and minimum of storage space required, also the variety of parts that pack easily in CARGOTAINERS.

At right, CARGOTAINERS again save additional handling time and costs at end of machining process on castings. Parts are easily packed back into CARGOTAINERS and moved to storage to await final assembly. The awkward gap between vendor and assembly plant is easily bridged with versatile, maneuverable CARGOTAINERS.

For further information on Pittsburgh CARGOTAINERS, write Pittsburgh Steel Products Company, Department AM, Grant Building, Pittsburgh 30, Pa.

CARGOTAINERS illustrated are in operation at both Pittsburgh DuBois Division and Monessen Foundry Division, Rockwell Manufacturing Company.

CARGOTAINERS by Pittsburgh Steel Products Company
Subsidiary of
Pittsburgh Steel Company

BAYFLEX®... ..the Answer to some "64 dollar" WELDING QUESTIONS

● Thousands of satisfied users will support our claim that Bayflex discs are unequaled for *fast*, *safe*, *clean* and *economical* grinding and finishing of steel welds, stainless welds, bronze, copper, aluminum or iron alloy surfaces. It will pay *you* to investigate this new labor-saving, money-making abrasive product.

Write us today for a demonstration — no obligation on your part.

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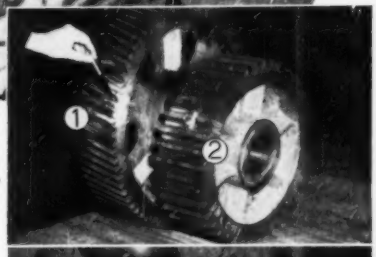
BAY STATE®

MEMBER OF THE GRINDING WHEEL INSTITUTE



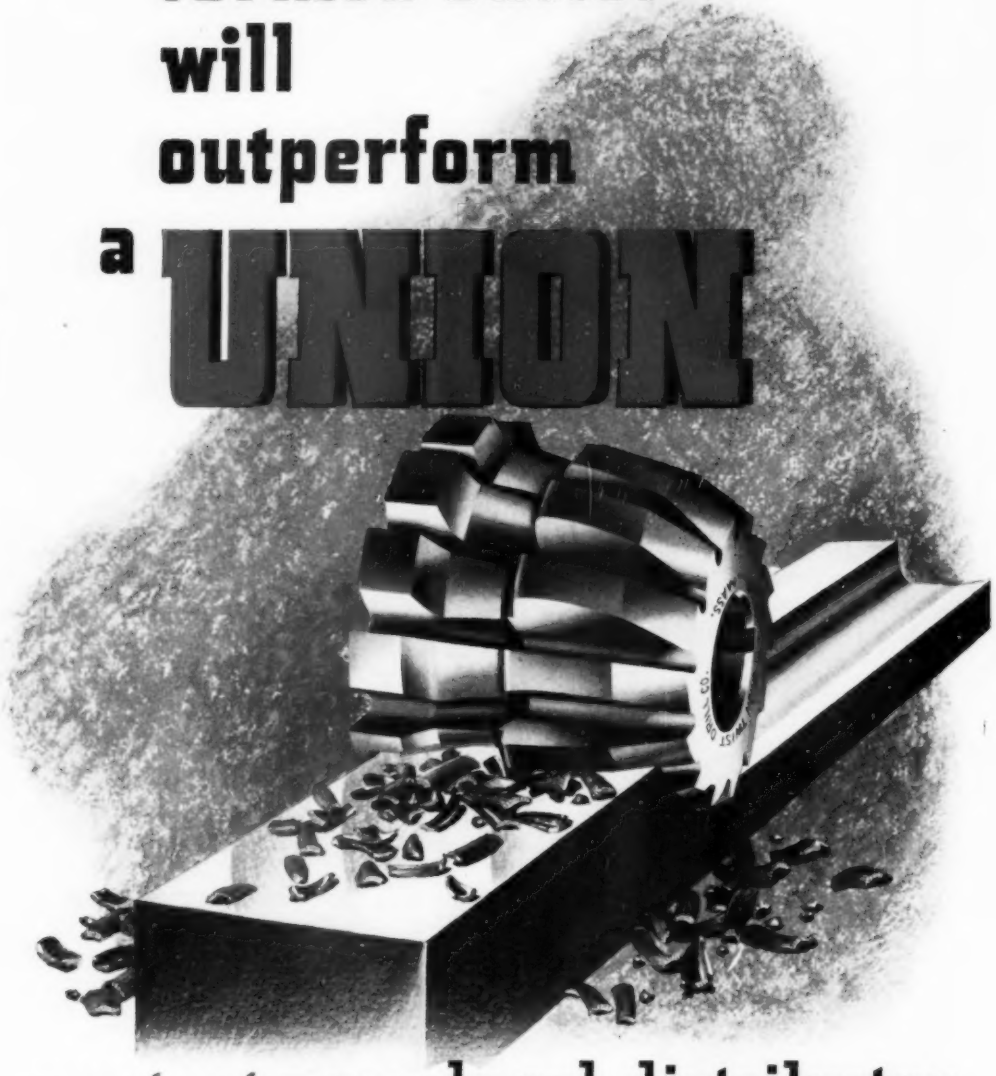
1. The excess metal-deposit on this job was removed by a 7"x 3/16"-24 grit disc.
2. A broken tooth prior to welding and smoothing.

Bayflex discs are unexcelled for smoothing welds . . . they outperform the ordinary coated abrasive disc 40 to 1 or better.

Preparation of cracks before welding . . . a typical application. Discs will fit all standard right angle head grinders and sanders, air or electric.

Top Performance Consistently Duplicated

no other formed cutter will outperform a UNION



contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under the heading "Drills, Twist".

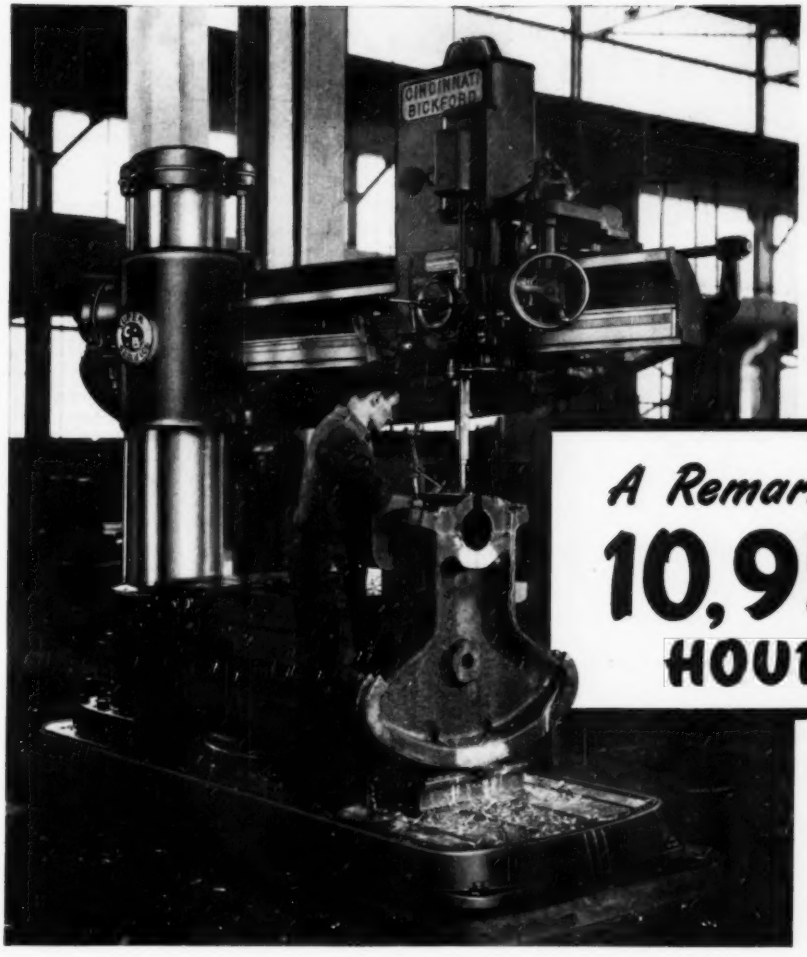
UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

MILLING CUTTERS • GEAR CUTTERS • TWIST DRILLS • HOBS • REAMERS • CARBIDE TOOLS

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass., Taps, Dies, Screw Plates.

BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers.

BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.



A Remarkable 10,950 HOURS

Perhaps the greatest test of both materials and workmanship in a machine is the test of uninterrupted production.

A Cincinnati Bickford Super Service Radial Drill was on a 24-hour schedule for 15 months at the Pittsburgh Steel Foundry, Glassport, Pa.

They tell us that the operators of this machine were not highly skilled but, due to the extreme simplicity of operation, did a fine job—and maintenance cost was zero over this period.

For durability, easy of operation and high production, use a Bickford Super Service Radial Drill.

Write for Bulletin R-24A.

THE CINCINNATI BICKFORD TOOL CO.
RADIAL AND UPRIGHT DRILLING MACHINES
SUPER SERVICE

Radials 7½" dia. col., 2½' arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
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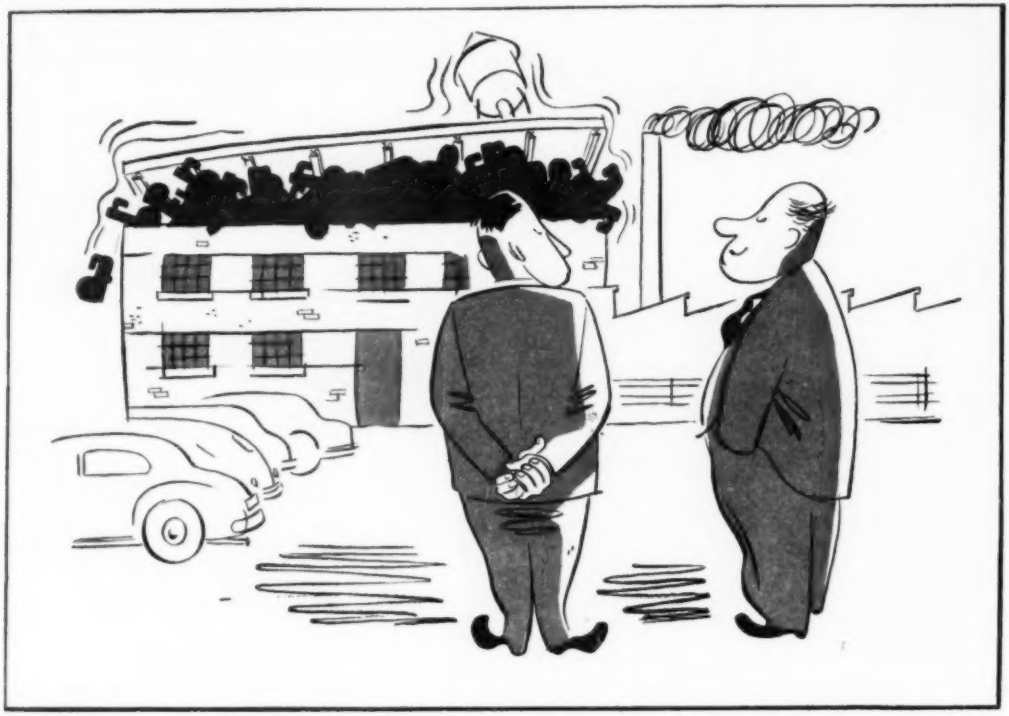
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.



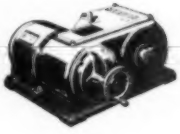
"Didn't I tell you Reeves Speed Control would raise our production ceiling?"

THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 15 hp.

MOTODRIVE combines motor, speed varying mechanism and reduction gears in single unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 20 hp.



● REEVES-equipped machines turn out more work and do more different jobs—more accurately and economically—because instant, infinitely variable REEVES Speed Control provides the right speed for every operation and every operator, under every changing condition. Specify REEVES Variable Speed Drives for your new machines—apply them to machines now in service. Let an experienced REEVES Speed Control engineer assist you in choosing the proper units for your operation from the complete REEVES line, including a wide range of designs, sizes and speed ratios—with manual, push-button or automatic control. Write for the catalog, No. A17-3N.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!

SPOT NEWS OF METALWORKING

One automobile manufacturer has pretty well perfected a new V-6 engine design that has had two years of research on the test track. It may not be introduced until 1951, as business is so good with present vertical six cylinder model.

Recent rise in steel scrap price at Detroit is due to restricted market. It is said dealers get less than 30% produced in this area. The rest is traded direct by the big manufacturers with the steel companies. Prices are not known. Dealers are the only ones trading in the open market and this accounts for a $2.00 per ton price rise recently.

One large car producer is experimenting with an entirely new type of conveyor for assembling cars. It will permit pulling any car off the line at any point for special handling or repair without disturbing the rest.

Manufacturers planning to move to new locations or to build new plants are being urged by Washington to choose sites in less industrialized areas, preferably in centers under 50,000 population. Defense officials are desirous of keeping new plants at least five miles away from important military targets.

Bulk of the $12 million ERP loan for the rehabilitation of the Italian Steel industry will be spent in the United States for the purchase of equipment. Plans call for the purchase of three rolling mills, one for 80-in. plate, one for wire, and third for billets. The new equipment will be earmarked for Piombino and Bagnoli.

An easily adjustable device for locating holes without jigs in drilling operations has been developed by a New England machine tool company.

French-designed Gregoire auto, on which production was abandoned in England, may yet get another lease of life in Australia. General Motors' former managing director is promoting his own company to build it there. The venture will be based mainly on assembly of British-made parts and subcontracted Australian-made components. Expected price: $1460.

West Coast airplane plant employees are reported jittery of stories that Washington intends to insist upon aircraft companies moving to the interior for national defense purposes. Boeing's expansion of its Wichita operations is a shining example.

New type of self-clinching nails for wood or asphalt shingles are being produced by Elastic Stop Nut at Union, N. J., at a rate sufficient to supply nails for 250 houses a day. Stainless steel type are being produced at the rate of 600,000 nails a day.

Another big automotive year in 1950 is foreseen by tire manufacturers who estimate slightly less than five million passenger cars and trucks will be built then. 1949 totals will be 5,800,000 units.

Carbide-tipped drills with central cooling of the HSS core are being developed by one auto builder to attain life between grinds equal to that of single-point tools in the same machine tool.

New high-speed welding equipment purchased by one major auto builder in past 18 months totals more than total previous purchases in company history. Most types are multiple-transformer units with as many as 130 guns discharging in a few seconds.

Gaging Metalworking

Metalworking operations will not be immediately affected by the coal strike or by the threatened steel strike. Manufacturers have an average of 60 days stocks of coal. They would go into a steel strike period with 30 days of steel inventory.

Despite the troubled labor situation and despite the devaluation of the pound, the metalworking outlook is promising. Activities should be sustained at the current level, or perhaps better, the remainder of the year. Some steel mills are predicting an ingot rate of 80-85% during the fourth quarter and through the first half of 1950.

If that prediction should hold, metalworking will do all right in the next nine months.

Good Automotive Year in 1950

Automotive people appear happy about next year. Not that it will rival this year, which may top the all-time peak in 1929 (5,650,000 passenger cars and trucks). But 1950 should see the assembly of 4.5 million units, and perhaps more. Tire makers who supply the automobile industry are guessing nearer 4.8 million, only a little short of the 5 million mark attained in 1947 and 1948 and already assured in 1949. A modest decline in car and truck assemblies is anticipated.

Appliance Business on Upgrade

The heavy appliance business has come back with a bang. Retail sales all summer were much bigger than expected. Stocks of refrigerators in the hands of certain makers were cleaned out completely. By miscalculation of the market, at least one company estimates that it built 25,000 fewer units than it could have sold. Now it is ready to introduce its 1950 models within the next month and its output will be at full plant capacity the rest of 1949.

This situation is typical of the refrigeration industry. The truth is that retail demand failed this year to follow the prewar pattern as predicted. Manufacturers went into the usual peak spring season with big stocks. But a cold spring held down sales and many companies cut back production.

Then June confounded the experts by beating May in sales. July added to the confusion by being as good as June, thanks to abnormally hot weather. August probably would have equaled July if dealers had possessed the stocks to fill the demand.

Cold-Rolled Sheets Strong

Advance in rail freight rates on September 1 put Pittsburgh steel mills at a further disadvantage on shipments into eastern states. Rail shipments from Pittsburgh to New York now are 62c. per cwt. compared with 36c. per cwt. in 1938.

Cold-rolled sheet steel mill capacity is filled for October and most of November. Big users have placed orders for November, with shipping schedules to be furnished later. Cold-rolled strip is in plentiful supply.

Steel plates, shapes and bars are coming back slowly from a slump. Some consumers have enough pipe and tubing that they will make only spot purchases in the fourth quarter.

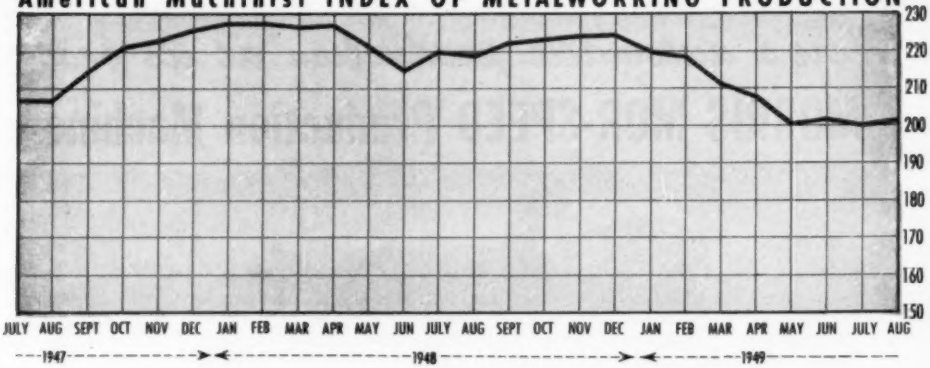
Copper Production Down

Here is the non-ferrous situation: Copper stays reasonably strong. However, domestic production is down to the level of consumption by fabricators. Users in many cases ap-

MACHINE TOOL ORDERS AND SHIPMENTS SHOW RISE IN AUGUST

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG
New Orders (Total)	87.0	80.9	93.5	70.1	63.7	53.6	48.0	p51.4
Foreign Orders (Included in Total)	21.9	26.5	22.3	23.1	15.9	15.7	14.0	p18.7
Shipments (Total)	68.8	70.3	75.8	74.9	72.8	79.0	60.7	p68.0

American Machinist INDEX OF METALWORKING PRODUCTION



INDEX		COMPONENTS				
		MACHINERY	ELECTRICAL MFG.	AUTOS, TRUCKS	TRANS-PORTATION EQUIP.	OTHER METAL-WORKING
Aug. 1949 (preliminary)	201	192	192	244	288	135
July 1949	200	198	191	234	279	135
Aug. 1948	219	247	225	224	306	146

AMERICAN MACHINIST'S INDEX OF METALWORKING is based on manhours worked in five segments, which are "weighted" as follows: Machinery, 32.5—Auto & Trucks, 22.6—Electrical Manufacturing, 15.4—Transportation Equipment, 12.4—All Other Metalworking, 17.1. Index figures are a percentage of 1939, which equals 100.

pear to be living on their inventories.

Aluminum stocks are ample and producers are actively soliciting business. Demand for zinc is terrific. Some zinc producers are oversold for the year. Lead is not doing too well; the government is buying 20,000 tons of lead a month. The tin situation is easier.

Machine Tool Gain Is Small

Though machine tool business has turned up, the increase has not been as great as expected. August new orders were only 5% better than in July, and September bookings have shown less gain over August than anticipated.

The August upturn, in fact, was entirely in export orders, which comprised 36% of the total. Domestic orders actually declined. August shipments rose to 68 on the NMTBA Index as against 60 in July.

It is too early yet to judge the effect of the pound devaluation upon machine tool export sales. Foreign builders benefit from devaluation by offering lower prices, of course, than heretofore prevailed.

No conclusive evidence is at hand as to what will happen to ECA-financed purchases of U.S. machine tools as a result of European countries being able to buy European-made machines at lower prices. Some $75 millions had been allocated for U.S. buying. Main hope rests in the fact that many machines essential for European and British retooling programs can be bought only in this country.

Makers of special-purpose machine tools are looking to Detroit for business in connection with tooling for 1951 models. Orders are likely to be placed well before the end of the year for some programs. Announcements of 1951 cars will be made next fall. New engines may be involved. Relatively little defense work is on machine tool builders' books.

Farm Equipment Makers Busy

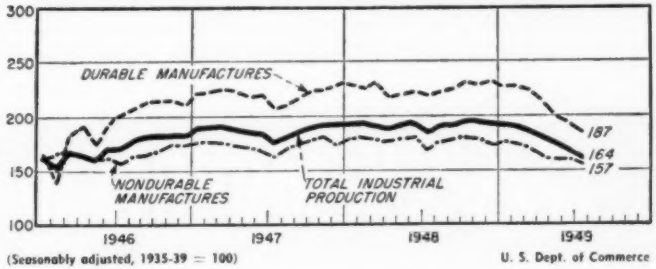
Farm implement companies still are turning out units at a high rate. International Harvester has temporarily suspended work at one plant because it cannot get strike-bound parts. Production is off some from the first-half, but not too much.

Construction machinery makers are feeling pretty good. Demand has held up well, and the outlook for the final quarter is promising. The volume of cash registers and accounting machines being produced is not far from the postwar peak. Diesel locomotive builders continue to run at full capacity. But backlogs are dwindling as production exceeds new orders.

Index Up in August

August showed a gain of a single point on the American Machinist Index of Metalworking Production. The upturn is traceable to a spurt of 10 points in the automotive component (remember automobile output soared to an all-time peak in August). Transportation other than automotive also scored an increase. The big drop was in the machinery component.

COMMERCE DEPARTMENT'S PRODUCTION INDEX SHOWS DROP

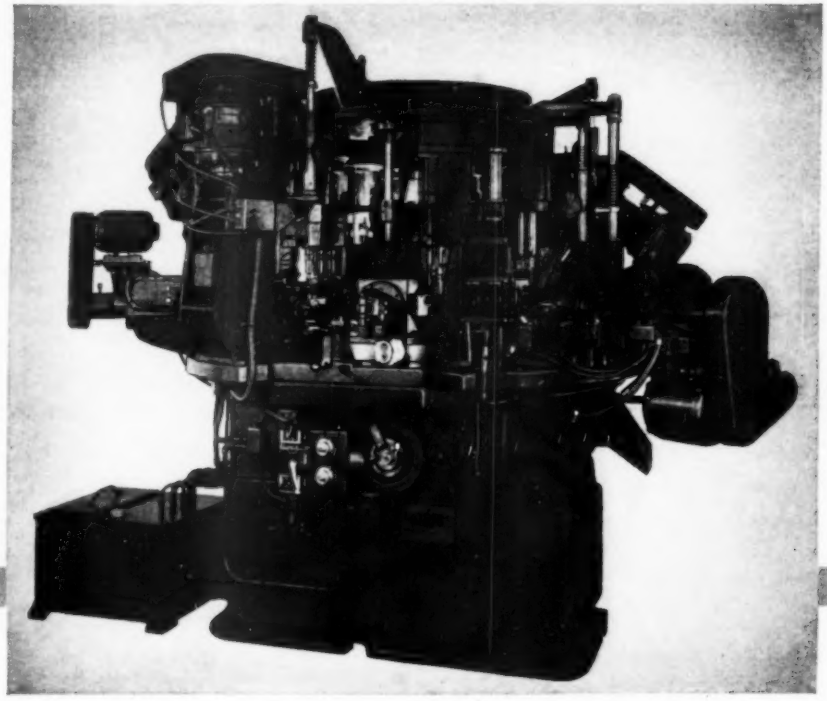


(Seasonably adjusted, 1935-39 = 100)

U. S. Dept. of Commerce

Here's automatic production at its best-

MORRIS MOR-SPEED Production Machine



● On this machine the operator merely loads and unloads the work while machine is operating on the piece. All machine functions including the indexing are automatic.

The machine drills—taps—spot-faces—and reams carburetor main bodies on a mass production basis for a prominent automobile concern.

The machine of vertical design has 12 automatic indexing four position fixtures, 20 drilling spindles, 7 facing spindles, 15 tapping spindles, 1 brush spindle and 4 reaming spindles and turns out a completed piece at every index of the turret.

Here is another typical instance of where Morris developed the machine to meet specific job conditions. If you are interested in the high production of work requiring drilling, reaming, tapping, facing and similar operations consult Morris—they have the experience, engineering ability and facilities to help you.

Write for our Mor-Speed Production Machine Bulletin showing the wide scope of our operations with specialized equipment.

Builders of MOR-SPEED Line

The MORRIS *Machine Tool Co.*

CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Workers Should Share the Cost

The report of the fact-finders in the steel labor controversy has implications which go far beyond the steel industry.

Provisions in the report for social insurance and pensions are a case in point. If saddled upon the steel companies, these provisions would set an unfortunate precedent.

Take a look at what the board members say, then analyze their logic. They argue that the steel industry's "immediate and generally foreseeable ability to pay" is not too important. More important is the "social obligation" resting upon the industry.

How come? How can the industry fulfill this social obligation unless it has "the immediate ability" to pay for it? We don't quite follow the reasoning.

The board members say that the net cost of social insurance and pensions can be absorbed by steel companies "without unduly narrowing the profit margin of the industry or its ability to hold or even lower its prices."

By what crystal ball is the board guided? Are its members, after a few weeks of hearings and study, so steeped in knowledge of the steel industry that they possess an unerring insight into the industry's economic future?

But even if the board could prove conclusively that the steel companies could afford to foot the bill alone, we think that any social insurance and pension plan is unsound unless employees contribute to it.

Federal social security has been based upon the contributory principle from the beginning. Every worker has a social security card and a social security number. What is more, he knows —or should know—that a slice is taken out of each pay check by the government for social security purposes.

He has the satisfaction, though, of knowing that he is helping to pay now for what he will receive later.

The steel industry's social insurance and pension plan should be established on the same premise, with both management and employees contributing. So should any such plan which is adopted by any manufacturer.

If any insurance and pension plan is worth anything at all, the worker should be willing to participate in it financially. After all, it is his plan, from which he alone benefits. He naturally values something which he helps to pay for more than he does a gratuity.

Moreover, there is less risk for the worker in a contributory plan. It is not subject to the whims and fortunes of the individual management. Joint responsibility preserves the individual's right to spend or save as he sees fit.

We do not quarrel with the general principle of social insurance and pensions. If the principle is here to stay and is to spread throughout industry, however, we urge that part of the cost be borne by employees who are the sole beneficiaries.

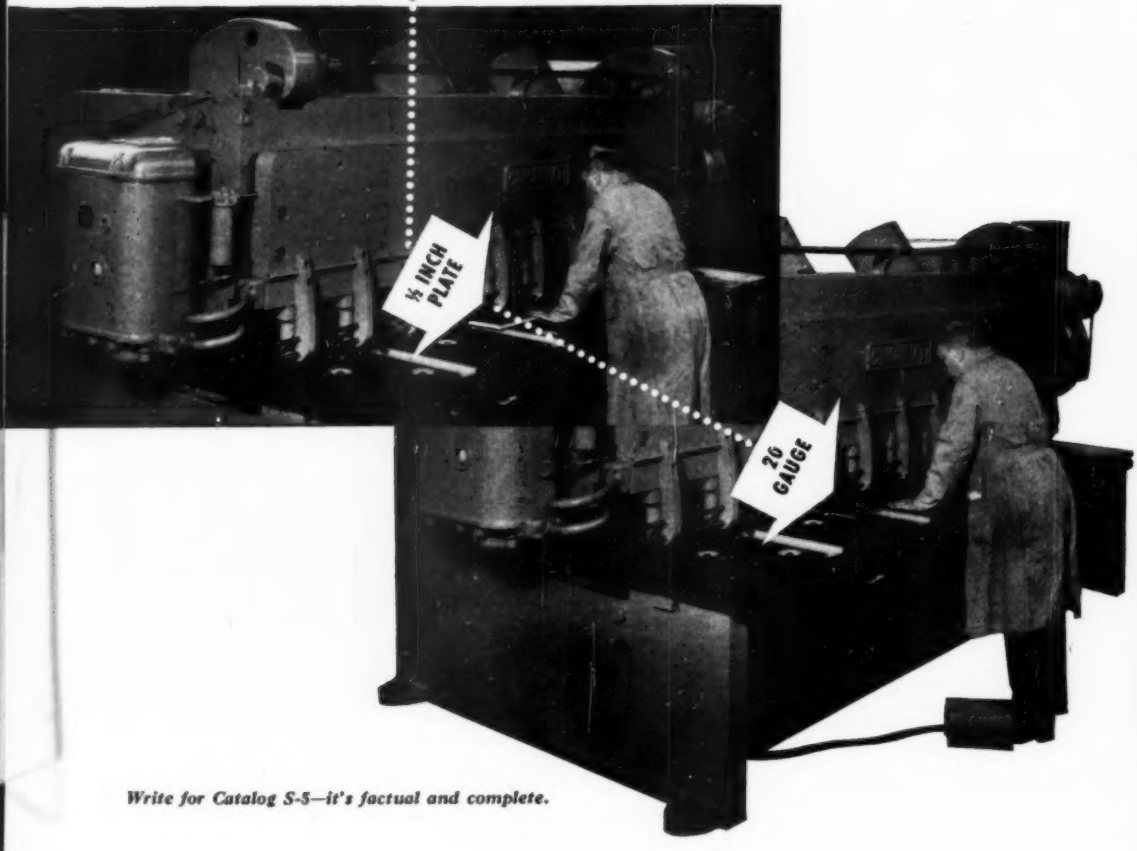
Burnham Finney

EDITOR

SHEAR ½" PLATE OR 20 GAUGE SHEETS

without changing knife clearance

ON A CINCINNATI . . .



Write for Catalog S-5—it's factual and complete.

. . . You do not change knife clearance for successful shearing of different thicknesses on a Cincinnati. Just set the clearance for the thinnest material and shear all thicknesses up to capacity. Thousands of Cincinnati Shears are used continuously in this manner. This practical method prevents accidental damage—saves time. Remember, changing knife clearance interrupts production. Investigate the Cincinnati All-Steel Shear and its accurate, time-saving features.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Cost Cutting Clinic

A COMPREHENSIVE COMPILATION OF IDEAS FOR YOUR COST-CONSCIOUS CONSIDERATION

WHEN costs must be cut, production cost is traditionally first under the knife. But costs must be examined all along the line, from sacrosanct "overhead" straight through to shipping and service. . . . Legend has it that department heads of a large refrigerator plant were in solemn cost conclave. "If we can cut $50 from the production cost of our most popular model, we can sweep the market," said Sales. Administration, Accounting, Legal, Engineering, Purchasing, *et al.*, were enthusiastic, but Manufacturing was hesitant. "I'd like to do it," he said, "but my cost on that model is only $40."

The thirteen vice-presidents of a railway-equipment company called in a consultant because production costs ate up so much of the sales dollar that the remainder wouldn't cover overhead. After six months of investigation, the consultant heaped insult upon injury by presenting an overhead-increasing bill and the report that production costs were well below those of comparable companies, but that there were twelve too many vice-presidents.

Sometimes, paradoxically, planned present cost increases may be essential to long-term cost reduction. For example, an old-line machine builder found costs were too high on his postwar designs. While hourly rates were comparable with those of competitors, his antique equipment was unable to maintain present-day production rates. The new designs have been sold, and the plant will be scrapped—because none of his inflated wartime income was plowed into modernization.

Bearing many such situations in mind, the editors of *American Machinist* have herein abandoned their customary concentration on production. Authors and manufacturers have been called upon to cooperate in providing their best current ideas for cutting costs, regardless of the sources of those costs. These hundreds of suggestions have been classified by subject and distilled into the succeeding 23 pages. Emphasis is, as might be expected, on production costs—but cents must be squeezed out of the cost dollar wherever it is spent. Detailed suggestions for making these savings and case studies appear, and have been appearing, in every issue of *American Machinist*, and will repay your careful study to implement the general suggestions here given.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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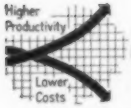


Cost Cutting Clinic

ADMINISTRATION

Prime essentials are a firm established policy and adequate liaison. . . . Weekly meetings of executives, with records of decisions for reference, are an integral part . . . Such meetings should be conferences, not state dinners, with participants seated and permitted to talk only

by rank . . . All ranks of supervision must be kept aware of the importance cost-wise of low inventory and low work-in process . . . Liaison must be close and constant between customer, sales, purchasing, engineering, production, accounting and other departments . . . Are administrative and staff departments carrying their weight, or are they refuges for incompetent and indigent relatives? . . . Are personnel and safety practices up to date? Is your staff function integrated, with each executive responsible individually for specific functions and to only one person on the next higher level? Divided responsibility means weakness . . . Are all of your supervisory channels adequately designated? An organization chart, posted conveniently, will help establish control and speed handling of problems.

Cost Accounting . . Keep records to determine your maintenance cost and history on each machine in the plant. A simple system for charging repairs to the individual machine will give you a useful record of the performance per dollar spent. Add "down" time to the record; it can be more costly than actual repair in lost production and customer good will. . . . Establish a record system based on the number of manhours available per unit time (day-week-month). Account for every manhour that you pay for. Make your record balance, plus and minus, until it zeros out. Include such items as production machining, tooling, stores, maintenance, "down" time, idle time, scrap and casting rejects, handling time, and administration—every process and function in the organization. . . . Standardize records companywide and arrange forms for multiple reports to eliminate duplication of work and figures . . . Insist on perpetual inventory records, with maximum and minimum levels for every item . . . Analyze the basis for your overhead factor. Is it really sound? Are you making one department carry the load for less-productive groups? . . . Are you taking full advantage of discounting bills?

Avoid . . Duplication on reports and records . . . Guessing at overhead factor and profit figures . . . Hasty estimating on work, without careful analysis of every contingent . . . Money tied up in overstocked inventories or dormant equipment . . . Independent departmental record systems that should be part of centralized companywide control—unless the department needs this information. Either absorb and standardize the system or eliminate it . . . Unnecessary red tape and paperwork.

PERSONNEL

General . . Most obvious cost savings lie in being sure that everyone in your organization is working efficiently . . . Less obvious, but just as important, is to be sure morale is maintained through your own honesty, fairness and cooperativeness . . . Someone in the highest echelons should be able to get along with people; company policy and situation should be explained through him to lower echelons . . . Don't depend on the "grapevine" to get the management story to bottom levels without distortion or falsification . . . Have a personal letter or equivalent to each employe once a month to give the situation; it must neither be a diatribe nor a short course in economics . . . Don't permit the "hat to be passed" every few weeks for some cause or other; encourage an employe-administered fund to take care of such appeals.

Foremen . . Foremen represent management to workers; they must have the authority, training and information to do so properly . . . Regular foremen's meetings, with ideas developed by the conference method (this is vital to all levels) are essential . . . Don't use meetings as opportunities to "lay down the law" . . . Foremen must be leaders, not drivers. They must know policies, training, quality control, salvage, job analysis and rating, routing, time study, setup, labor legislation, etc. . . . Have foremen spend some time in functional departments such as time

study and planning (if they exist) so they understand and cooperate.

Recruiting . . Weed out incompetents, malcontents and drifters by proper hiring procedure, including adequate interviews and tests . . . Be sure policy and procedure are understood at once, and that each new man is introduced and instructed in his duties.

Incentives . . Have a fair, well-organized, incentive plan . . . Don't promise or suggest things you are not positive you can deliver . . . Encourage ambition; provide the opportunity for advancement . . . Promote from within and make available the instruction and training to make such promotion possible . . . Be sure every executive has a competent understudy . . . Organize and maintain a practical suggestion system, with a competent suggestion committee and publicity on awards . . . Show no partiality . . . Make every man feel he is "part of the family."

Maintenance . . Treat maintenance men like production men; provide incentives, instruction and opportunity for advancement . . . Insure adequate maintenance and insist upon good plant keeping; both promote morale and improve customer relations . . . Be sure the maintenance force is adequate and competent by using training programs including films which are available from manufacturers.

SAFETY

Remember that every accident increases costs—in lost time, in compensation, in training, in morale—and that 85% of accidents result from unsafe acts, only 15% from unsafe equipment. Concentrate on building employe consciousness of unsafe methods; parallel regulations on guarding and safety clothing with education in safe practices . . . Prove by your example that management is solidly behind the safety program.

Administration . . Organize a safety committee composed of management, supervision and employes; have regular meetings, an elected chairman and keep minutes for the record . . . Ask employes for safety suggestions, and reward suggestors for good ones . . . Have a safety inspector on duty at all times and appoint deputy inspectors in each department . . . Try safety contests to stir interest . . . Have a safety director and see that he keeps accurate cost records by reviewing them with him at least every six months . . . Classify unsafe habits with tardiness, absenteeism, poor work and neglect ,and provide similar penalties . . . Get posters, charts, leaflets, movies, editorial items and other material from the National Safety Council and equipment manufacturers, and use them . . . Keep safety displays and literature current by changing it frequently . . . Provide an adequate budget for safety work.

Check frequently to see that safety standards are being maintained. Support your safety director in enforcing the rules of safe practice and eliminating unsafe methods.

First Aid . . Have a registered nurse in attendance if plant size warrants, and a doctor on call. If your plant is small, have one or more supervisors trained in first aid, and prohibit untrained employes from giving first aid to each other except in emergency . . . Provide an adequately equipped first-aid room, and inspect it frequently. Provide suitable protective and first aid equipment adjacent to hazardous operations.

Hazards . . Segregate fire hazards and plan fire control . . . Require suitable protective equipment for each hazard and insist that it be used . . . Require that purchased equipment be adequately guarded, and that operators of such units as grinding wheels and saws stand out of the line of flight of a shattered or broken tool . . . Enforce the same standards of operational safety on maintenance equipment as on productive units . . . Standardize your safety equipment to guard against your particular hazards; don't buy every safety gadget just because it is new.

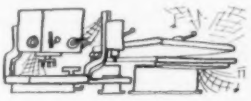
Eyes . . An adequate eye-safety program is a first-class investment; it frequently pays for itself in six months . . . Outlay for safety glasses is low; returns are exceptionally large . . . Enforce the wearing of proper eye protection, but make it easy to enforce by fitting goggles or glasses properly and selecting them to suit the hazard.

Clothing . . Provide proper protective clothing for every hazardous operation, and go beyond that to provide safety shoes and the like for all employes at cost . . . Be sure that safety clothing is as attractive and comfortable to wear as normal work clothing.

General . . Insist that no man, including supervision, is so skilled he can afford to disregard customary safety precautions . . . Make your own habits and costume conform to your rules.

PLANNING

Analyze all operations for ultimate elimination. Combine operations where handling can be reduced, and savings can be made. Examine operations for possible change of sequence which will provide production improvements . . . A system of coordinated carbide control will improve quality and reduce machining costs at every operation . . . See that sufficient machinability records or ratings are maintained to allow a truly economic comparison of materials and methods . . . Remember that some operations which cause trouble may be eliminated by a slight change in product or tool design. Example: a slight change in design made it possible to transfer a job from a standard engine lathe to an automatic-cycle machine. Though it did not seem possible at first, this improved the time and eliminated a bottleneck . . . A super spacer will eliminate drill jigs, milling fixtures, and much layout work . . . Try painting each jig, fixture, and die, plus components with a color code. Carry out the colors at the appropriate space in the storage rack for ease of location and selection . . . Plan for both long and short range operation, with the two coordinated, but sufficiently flexible to permit changes.



STORES

Storage . . Protect material in storage from rust, corrosion, mildew, vermin, etc. . . . Common practice is to allow castings and forgings to age by exposure to the elements. Proper heat treatment will be faster and more reliable, and will reduce the need for large inventories. Furthermore, it will permit the use of smaller machining allowances. . . . Employ a distinctive color coding to designate different specifications of steels and other materials, but do not confine its use to bar ends as these may be cut off accidentally. Instead, paint a full-length stripe or bands at short intervals . . . Issue stock only on proper requisitions and maintain a running inventory . . . Establish minimum and maximum stocks for all types of material and see that they are rigidly maintained . . . Do not permit bar ends to be thrown into scrap bins. Keep them segregated and use them for small jobs.

Parts in semi-finished and finished stores require particular attention to corrosion prevention and finished parts, especially, should be protected against scratching, marring, or other injury . . . Register all material into and out of stores, and where the product is easily portable do not permit access by other than authorized personnel . . . Use counting scales for small uniform parts such as screws

and nuts . . . Issue soaps, detergents and similar materials in accurately weighed amounts, preferably in paper bags or other containers. A few casual handfuls given out every day will mean substantial amounts at the end of a year . . . Store and ship in palletized loads wherever possible, and use power lift trucks and stackers to save floor space and labor.

Store flammable, corrosive or other dangerous materials in a separate room under lock and key. . . . Provide protective clothing and safety handling equipment for all such materials. See that gasoline and similar flammable liquids are issued only in safety containers, and acids only in rubber or earthenware receptacles . . . Provide proper cradles for carboys and drums, and watch for leaks. Use absorbent material to catch drippings . . . Indicate clearly the contents of all drums and other containers and see that contents are transferred to other receptacles in a safe and proper manner . . . Provide hoists for heavy material.

Issue tools on tool requisitions only . . . Maintain adequate stocks of all tools . . . Inspect tools when they are returned to the crib and have them sharpened or adjusted as needed . . . Mark all company-owned tools and gages, particularly items such as micrometers and calipers, with the company name . . . When workers use their own micrometers, have them checked and adjusted as carefully as company-owned tools . . . When tools are used in sets for production jobs, keep them together in the crib in suitable containers, and issue them as a unit. Check that all items are present when the set is returned. . . . Launderable wiping towels are usually more economical than old rags and less likely to be wasted. . . . Lint-free dusters are essential on some jobs, but see they are not issued for general use.

Protect edged tools in storage from contact with hard objects. Canvas sleeves or peelable plastic coatings will pay for themselves many times over in the protection they offer . . . Metal shelves or bins are suitable for many tools, but non-metallic liners are advisible for cutting tools. Try using peg boards for milling and gear shaping cutters . . . Have tools sharpened by experts using proper equipment, and remember that carbides require special wheels.

SHIPPING

Packing . . Study each packaging problem to insure putting the maximum of material into minimum space . . . Consider shipping your product partially disassembled if this will reduce the size of the package . . . Engineer all packing cases, crates and boxes to utilize a minimum of material and labor consistent with adequate protection . . . Ship palletized loads where possible . . . Where containers must be kept right side up,

don't rely on stencilled signs, design the box so it will not stand on its top . . . Standardize containers as far as possible and use machine-made shooks. They are cheaper than individually made boxes . . . Attach uncrating instructions to the outside of the box, clearly marked, and in a place where they will not be torn off. It is no use putting them inside where they cannot be found until after the damage has been done . . . Finely finished parts require special protection against corrosion in transit. Make sure that wrapping paper is acid-free and that packages are sealed against moisture. Or try a vapor-type inhibitor, or moisture-absorbent chemicals.

Study truck routes carefully with due regard for low bridges, weight-restricted roads and bridges, and other road hazards . . . With extremely large items whose bulk may necessitate a complicated and roundabout shipping route, consider doing final assembly at customer's plant . . . Consider climatic conditions through which package must pass and prepare accordingly. Export packages require greater protection than domestic . . . Indicate sling positions, or provide suitable hooks or eyebolts . . . Brace contents against sides of boxes to prevent shifting, but be sure the supports are against solid material that is not easily bent or broken . . . Mark consignee's name and address clearly and indelibly, and don't forget the purchase order number and number of packages.

SALES

Sales . . Selling starts with the creation of an inquiry. If you want to sell you must have the ability to create inquiries . . . Inquiries may be from a desire to reduce manufacturing costs, increase production, or replace old equipment. Be prepared to show how your equipment is best able to satisfy all these demands . . . Develop vision and imagination in your sales engineers. Analyze what customers want and provide it for them . . . Before calling on a prospective customer, review all of the equipment that you have to offer and prepare to give him some information of value to his responsibility Check the number of inquiries received and the percentage of these turned into orders. It is a good measure of your sales potential.

Learn the number of manhours necessary to produce specific amounts of dollar sales and keep a chart of these regularly. Teach your salesmen how and where to avoid wasting large sums by poorly planned or unplanned effort . . . Avoid having more than one associate accompany the salesman, to prevent the buyer from feeling

that he is being "ganged" . . . Avoid talking about irrelevant things to excess. Many salesmen do . . . If you don't know the answer, say so—then get it quickly . . . Check your competitors' products constantly. Know not only where yours are superior, but also where his are. Be prepared to discuss this intelligently when it is mentioned by customers. Avoid being put in a defensive position, but *NEVER* slander a competitor's product.

PURCHASING

Ordering . . See that definite minimum quantities of stock items are posted on stock records. Provide material control with average delivery time for these items to permit them to plan for replacement. Get a check list of items reaching minimum and reorder immediately to prevent shortage . . . Take advantage of local purchase facilities. It creates good will and very often local dealers can get better delivery and better prices through large quantity purchases. Their interest is more personal, especially for emergency requests.

A group of small companies can very often profit by arranging a central, cooperative purchasing group to buy in larger quantities and keep better control on price and delivery . . . Check on transportation for every order. Are you asking for the most economical method for the desired conditions? . . . Check new equipment, parts, and materials sections in trade publications regularly. It is a good way to keep informed about latest manufacturing methods . . . Place open orders monthly with suppliers of fast-moving items, to minimize paper work and accounting. But set a maximum limit on each order . . . Set a reasonably high limit on petty-cash purchases, perhaps $10, and get a duplicate bill for every purchase to maintain control . . . Allocate the cost of purchasing to each department and include it in their operating overhead to control irrational ordering.

ENGINEERING

Designing . . Keep drawings as simple as possible. Greater clarity speeds reading and understanding on the part of all people who use them . . . Be sure proper tolerances, material specifications and the like are shown, that dimensioning is done from proper points or surfaces (those which will be used in the shop for locating and inspecting) . . . Use locating points on surfaces that can be used for all fabricating operations . . . Try to have accuracy depend upon certain key operations rather than on closely held limits all through production . . . Have standards for commonly used parts and adhere to them to cut inventory and unit price. Also have standard design practices and methods to reduce gaging and assembly equipment . . . Limit the number of men on any design job to minimize discussion . . . Classify references (electrical, hydraulic, mechanical, etc.) to simplify reference . . . Avoid changes in basic idea after layout is begun . . . Use rubber stamps to reproduce standard parts, symbols, standard notes, type boxes, etc.

Drawings . . Select and maintain a standardized drawing numbering system; microfilm drawings used only occasionally for reference . . . Cross-index drawings by number and name . . . Install display panels of standard items for instant reference and recognition . . . Use sketches for experimental developments, then formal drawings when the bugs are out . . . Make every effort to stick to standard nomenclature . . . Use templets and slide-rule computers wherever possible . . . Keep all information of a general character and any other information of value in assembly on the assembly drawing. More specific information should be limited to the detail drawings. Avoid crowding the paper. Carefully choose quality of paper and pencils to insure good blueprints.

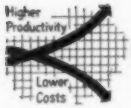
Keep the scale as small as ease and convenience of reading will permit . . . Limit views to those necessary to present the part clearly and completely . . . Use sectional views to simplify interpretation . . . Keep all notes concise. Don't sacrifice clearness or completeness of meaning . . . Engineering material symbols should be kept standard and up-to-date . . . Avoid the one-man mental index. His absence will tie up production.

Insist that every draftsman and designer keep a daily record of his work . . . Show not only what is wanted when the piece is finished, but also any specific or precise condition of the part which must be maintained during manufacturing . . . Avoid cluttering drawings with unnecessary views, notes or dimensions . . . Be consistent, preferably following well-established standards . . . Avoid the use of nonstandard or confusing abbreviations . . . Establish a definite standard method of dimensioning. Be sure that dimension limits and allowable finish are clearly stated on every drawing . . . Eliminate tolerances printed on standard drawing forms when this accuracy does not apply.

Drafting Room . . Check that illumination is adequate for comfortable seeing . . . Cramped backs cause cramped minds—see that each man is comfortable at his board . . . Be sure proper drafting tools are provided . . . Use project teams and have one team specialize in rush work, short jobs and drawing changes . . . Insist that drawing changes be authorized by supervision before adoption . . . A capable, diplomatic, toolmaker, ready for retirement, can more than earn his salary as a practical consultant on tool and part design . . . See that every draftsman has a basic orientation course covering production equipment in your plant . . . Maintain an uptodate file of bulletins, catalogs and technical literature.

Worn, faded, and stained original drawings may now be restored photographically in normal room light to produce top-quality shop prints without the need of retracing and rechecking . . . Engineering prints made from long-lived photographic intermediates or "printing masters" permit original drawings to be preserved in good condition for design changes.

Engineering Materials . . Work with your purchasing agent. Specify the best material at a price consistent with desired quality . . . Keep uptodate on new materials . . . Establish a company catalog of standard materials and work from this . . . Prepare a tentative materials list when design is started. Have this checked by expediter or stock-control clerk so material is on hand when needed . . . Select materials with the lightest weight consistent with balance, strength and durability . . . Ideal design materials are not always the most efficient from production standpoints.



Cost Cutting Clinic

Select materials for both purpose and workability . . . Consider a cheaper alloy. A slight change in fabricating operation may make it just as efficient at a lower cost.

In specifying vendor parts remember that the tolerance influences the price. Avoid unnecessarily close tolerances "just to be on the safe side" . . . Cooperate closely with vendors. Whatever time you save them is money in your pocket . . . For parts which require turning and grinding, specify the closest practical tolerance where the dimension is to be turned to minimize the more expensive grinding time.

Can castings be secondary metal where they are non-structural? . . . Are you manufacturing parts made in large quantities for other industries? . . . Use the services of manufacturers' sales engineers. Their experience can save you money . . . Study each part for simplification or elimination. Reduce fatigue failures in machine parts by using simulated tests on full-sized parts . . . Avoid grief by discussing fillet proportions and section thickness with foundrymen before construction of the pattern . . . Consider interrelated needs: depth of hardening, size or severity of quench needed to produce hardening and necessary yield strength . . . Keep the new materials in mind, such as powder metals, electroforming methods, and super-adhesives . . . Learn the special properties of the various materials and the cost savings offered by each.

Castings . . Keep casting depth at a minimum . . . Design for minimum weight while allowing sufficient thickness to avoid chilling . . . Keep form simple . . . Provide liberal radii wherever possible . . . Keep accurate related surfaces in the same part of the pattern, or where quantities justify it, use metal patterns instead of wood or permanent molds instead of metal patterns . . . Avoid sharp corners . . . Place parting lines to avoid later grinding if possible . . . Avoid baked cores where possible.

Molded Parts . . Check commercially available stock molding before you design a special part . . . Simplicity in part shape and minimum number of parts are both economical . . . Keep weight at a minimum . . . Be sure type of plastic and quality are both suitable . . . Plan inserts simple to fabricate (i.e., from bar stock) . . . Avoid odd projections and flash lines where they'll require finishing . . . Follow standard designs or at least standardize key dimensions for similar parts.

Process Selection . . Engineering is frequently guilty of selecting a familiar fabrication process instead of the most economical one . . . Depending on quantity and shape, consider both casting and welded fabrication (torch-cut parts), or combinations. Weigh these against die casting and molded plastic . . . After process is selected, compare cost of assembly methods such as spot and projection welding, induction brazing, preformed solder or brazing material, solid or hollow rivets, self-tapping screws, bolt and washer assemblies.

Pressworking . . Use fabricated formed parts to replace cast or machined parts for small quantities or where relative costs justify. Try to nest blanked parts to minimize scrap . . . Use coil stock to permit automatic feeding. Compare cost of drawing with that of spinning, forging and welded assembly . . . Avoid deep draws or draws that could be forming operations . . . Don't make parts from sheet that can be made from strip or wire. If holes must be accurately interrelated, punch them simultaneously.

Machining . . Consider tubing or pre-formed material to reduce machining . . . Reduce the number of shoulders . . . Allow a radius or undercut at shoulders . . . Don't specify a better machine finish than is required, but don't have separate roughing and finishing operations if a better-controlled first operation will provide suitable finish . . . Don't design for the screw machine parts that can be made on a cold header . . . Turning is usually faster than shaping or grinding . . . Use centerless instead of between-centers grinding if possible . . . Avoid tapers and formed contours . . . Use rolled threads instead of cut threads . . . Allow at least 2½ imperfect threads at the end of a thread to permit use of chasers with 15° throat angle. This permits use of harder, wider chasers and results in cheaper threading . . . Specify surface finish as you specify other dimensions in definite tolerance . . . Check with the plant to be sure your design does not require back tracking of the part on the line in order to do some special machining job.

Assembly . . Make assembly progressive . . . Be sure components are made right to reduce fitting and adjusting in assembly . . . If welding, keep weld size to a minimum . . . Avoid vertical or overhead welds; use downhand welds where possible . . . Intermittent welds are more efficient than continuous ones . . . Torch cutting is economical for complex shapes and parts; they can be nested to reduce scrap . . . Unless welds must be flush, avoid chamfering edges.

Finishes . . Use fewer or thinner finish coats . . . Design for easy application of finish . . . Use preplated or precoated stock whenever possible . . . Be sure the finish is right . . . Salvage overspray drip and so forth . . . Consider infrared drying to save floor space . . . Consider overhead drying areas through which painting conveyors can be looped.

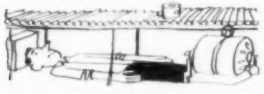
Planning . . Work with purchasing and production men to decide which parts and assemblies are cheaper to make and which are cheaper to buy . . . Discuss design details or plans to see if a minor change will result in reduced cost . . . Consider customer requirements and be sure the design does not involve tolerances or finishes or materials better, and hence more costly, than those specified . . . Be sure all known competing developments have been considered . . . Incorporate interchangeable and standard parts as completely as possible . . . Discuss safety aspects

of the design . . . See if an assembly or unit already in production can replace this one or part of it . . . Be sure all alternate designs are considered . . . Strive for simplicity.

PLANT

Building . . To gain space in existing building, use mechanical handling for high-piling in stores: Fork trucks, and similar stacking machines, have taken the labor out of high stocking. Only the crushing or tipping of materials limits the pile height . . . Generally, mechanical piling cuts storage space in half . . . Consider overhead handling. Check the practicability of mezzanines. In both cases, you must thoroughly investigate the building strength . . . Subcontract less-specialized work if this can be negotiated in sufficient quantities to meet your own production cost (you may even save money). This is only feasible if you can be assured of a continuing supply to meet your schedules . . . Consider the outdoor or semi-inclosed performance of suitable operations . . . Utilize outdoor storage for all materials that won't be harmed by the elements.

Build cheap sheds or pre-fabs for storage of spare machines and parts. This is particularly useful for maintenance materials . . . Reduce inventories through careful receipt scheduling, improved order follow-up and expediting, plus material control . . . Space under



assembly tables and conveyors is excellent for storing parts used at these locations . . . Production areas should carry only working inventories. Supplies can be replenished either in off-shift periods or at regular intervals that least interfere with production. Centralized storage relieves valuable manufacturing space . . . Carefully evaluate all space. Keep aisleways from beneath cranes wherever possible. Arrange feeder departments for small components in low-headroom areas . . . Carefully ventilate machines that throw off fumes, dust, or grit, so they won't require excessive surrounding space to prevent their interference with nearby operations . . . Train your personnel to be space and safety conscious.

Heating and Ventilating . . Hot and smoky departments such as forge shops, pickling rooms, and heat-treating departments can be made comparatively comfortable by vertical fans to carry heat and fumes out in the shortest possible time. This will materially improve production in these departments. Even if the plant is air conditioned, these fans are advisable, plus curtain walls coming down to 8 ft or so over the floor, to trap heat and fumes . . . Automatic or semi-automatic plant heating controls require fewer attendants, reduce power, fuel, and water costs, and provide more uniform temperature than manual control . . . Paint flat roofs aluminum, provide means for flooding them, or do both, to reflect heat of summer sun . . . Establish a definite policy on opening or closing of windows or doors for ventilation. Continual differences of opinion on this subject when left to employees will cause trouble . . . If your plant is totally air-conditioned, keep indoor temperature at maximum of 10° below outdoor temperature during very hot weather. Personnel will be comfortable and not as subject to heat stroke as they leave the building . . . Use unit space heaters at doors frequently opened to maintain even building temperature and prevent cold drafts.

Lighting Efficiency . . Good lighting improves volume of production and reduces scrap. Provide sufficient overhead lighting (mixture of fluorescent and incandescent is best) for good general visibility and auxiliary lamps on all equipment for highlighting details . . . Have all lamps and reflectors cleaned systematically — particularly on machinery that throws oil or coolant. A little dirt wastes a lot of light—and power . . . Windows and skylights provide the best illumination at the lowest cost —install as many as possible . . . Consider dropping lighting fixtures to a lower position to spread more candlepower on the working surfaces. False ceilings for lighting fixtures Improve lighting and appearance; provide space for ventilation, heating, and sound absorption.

Paint . . Properly selected and applied, paint will influence production by improving worker morale and comfort . . . Color harmony and cleanliness in the shop will give customers an impression of efficiency and modern methods . . . Ceiling paints should be light, but only slightly glazed. Reflective paints promote light economy, but only to a point. Beyond this point, glare is created which causes the operator to dodge light instead of seek it . . . Plan every stroke of paint with a color purpose as well as a protective function . . . Paint floors to keep down dust, particularly cement floors . . . Don't buy the cheapest paint for price alone —application costs more than material and length of service is important . . . Paint every section according to schedule—not just when the place looks shoddy. Preventive maintenance is less expensive than major over-all repair.

Sanitation and Cleaning . . Furnish each department with an adequate number of easily opened rubbish containers with attached covers. Employees can then easily dispose of rubbish properly instead of dropping it on the floor . . . Use portable, power-operated cleaning

equipment wherever possible. Provide portable industrial vacuum cleaners for operators to use at machines that occasionally cut materials such as plastics or resins which produce fine powder . . . Allot time for cleaning hard-to-reach and expensive precision machine tools, rather than depending on hit-or-miss random schedules . . . Purchase cleaning materials in bulk. Standardize the selection and try using concentrated forms for space and cost saving.

Provide plenty of hot water for personal washing. It saves soap, reduces wash-up time, and helps avoid dermatitis . . . Avoid harsh,

abrasive soaps which irritate skin and clog drains . . . Although major clean-up may be accomplished during off-shift hours, a roving sweeper crew during working hours will improve appearance and minimize accident hazards . . . Be sure that expensive equipment is not being ruined through lack of cleaning it or the area surrounding it . . . Install sediment traps wherever a large quantity of insoluble material is run into a drain.

Power, Air . . Provide adequate power for maximum use of all equipment, with power panels conveniently located in each department . . . Use circuit breakers rather than fuses wherever possible . . . Install the unit-type functional conduit that permits simply plugging in to tap power at any point on the line . . . Stagger starting of large motors or groups of motors to avoid overloading lines and generators . . . Use individual rectifiers rather than motor-generators to supply direct current for magnetic holding. Devise means to warn machine operators when power drops 10% . . . Argon glow-lamps in the circuit of each motor or magnet will show at a glance when power is on. This will minimize power-waste on idle equipment.

Provide sufficient air volume as well as pressure and avoid the false economy of using small main feed lines for air . . . Remember that air powered tools are affected at all locations when power is insufficient . . . Avoid right-angle fittings on air lines as this will cause considerable pressure loss by friction . . . Beware of the smallest leaks—it is said that a single ¼-in. dia hole in a compressed-air system costs $100 per month . . . Locate power and air distribution center to the load area center. This will mean shorter branch runs of wires and pipes; lower leakage cost and less maintenance . . . Install sufficient pipe and outlets so that no air hose need be more than 6-10 ft long . . . Use spring chuck type fittings with built-in valve for speed in connecting to lines . . . Be generous with filters and dryers to protect air motors and cylinders . . . Pressure at the compressor means very little, install hypodermic type pressure gages at each air tool to show actual individual working pressure. This will also serve as a safety warning when pressure drops on air holding devices . . . See that all air equipment is properly maintained to reduce power loss . . . Find out exactly what your air power is costing and start from this point.

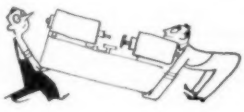
EQUIPMENT

Arrangement . . Work with a good scale drawing and templets. Mark off on each layout operator's position and indicate area required. Use a separate templet for work area of machine. Floor plan should include men, machines, offices, stores, hoisting, and materials handling equipment . . . Go to the operator of each piece of equipment for suggestions. Discuss with them any moves which may affect them or their equipment. Never plan without the advice of the person who will supervise the use of equipment as revised . . . Arrange machinery and equipment for the most expeditious handling. Centralized in-process storage areas often prove advantageous . . . Avoid the details until the over-all plan is roughed out. You may find that operations are eliminated, combined or changed in sequence as the planning progresses . . . Grouping machines simply to have like machines together is inefficient. Place machines where they are functional to operation sequence and minimize materials handling . . . Install grinders and abrasive equipment as far as possible from other machine tools such as lathes, planers, and milling machines. Separate punch presses, shapers, planers or forge from precision boring and turning machines.

Make a general check of your present arrangement for flow of material. Trace the most predominant product through the equipment by using flow charts. Check every machine for accessibility, adequate aisles. Check lighting, ventilation, heating, safety, air supply, power, and fire hazard common to each group of, or individual, machines. Be careful to include all of these considerations in any rearrangement.

Maintenance . . Locate the maintenance department as near the center of their service area as possible . . . Don't install equipment in your maintenance department which is duplicated in the shop, and has time open for maintenance work . . . Furnish portable power machinery so that equipment can be moved to the job, instead of the job to the equipment. In large plants, work-shop trucks can save a lot of time . . . Establish a routine schedule for checking all equipment periodically. Preventive maintenance will minimize breakdowns which result in lost production . . . Avoid making every repair part in your shop. Replacement parts are usually less expensive when bought from the manufacturer. But stock only those parts which your records show should be stocked—and keep these records up to date . . . Be sure that maintenance manuals for each machine are available from your files. Make them required reading for maintenance personnel . . . Sloppy installations cost money. A complete follow through by a competent supervisor will insure more production with better quality work at lower cost . . . Constantly use comparative time and cost ratios as a guide to improvement.

You can only expect good work from your maintenance department if you provide adequate equipment. Poor maintenance can be the beginning of a chain reaction of production losses . . . See that production supervisors give maintenance work top priority to minimize down-time in other sections . . .



Provide proper means to lift complete machine or subassemblies, so that ropes or cables do not bind any part of the machine and cause damage. Jack screws and

holes for hold-down bolts should be carefully arranged around the base. Means for leveling must be provided . . . In plants of sufficient size, a hydraulic machinery-handling truck will provide a rapid means of moving and positioning heavy machinery . . . Megger test all motors every 60-90 days. Reading will show if motor insulation is breaking down and allow you to schedule repair during off-hours, thus avoiding lost production time . . . Select fuses into which only the correct size element may be inserted.

Save the sludge from your degreasing machine. Even with a still attached to the degreaser you can save from 20-80% of the solvent. The recovery charges will be so little that at present prices you may save from 70-80 cents per gallon in recovered solvents. Avoid mixing degreasing solvents with lacquer or paint.

Materials Handling . . Get a detailed report showing exactly what materials handling is costing you *now*. Study methods and equipment used at present; call in manufacturers of handling equipment and check their claims. Be sure that competitive equipment is of the same capacity when comparing prices. Work with your production planning department to eliminate as much handling as possible. Sound planning can show big savings in handling costs . . . Don't plan at random—establish a definite responsibility for the super-

vision of handling activities . . . Avoid working without facts. Check your costs by observing specific jobs. You may be shocked into moving more of your equipment from one department to another than you expect . . . Never feel that your handling methods are perfect. Keep a constant lookout for improved methods and equipment . . . Record maintenance activity on handling equipment.

Rearrange equipment where necessary to get proper flow, but only after careful thought . . . Don't work on details until you have an over-all picture . . . Don't have too much storage space around machines as it encourages poor planning . . . Avoid going overboard on any one type of handling equipment. Investigate various types before making a decision . . . Can you arrange machines to transfer the material directly from one unit to another? . . . Is it possible to pump or blow the material with no handling whatsoever? . . Hand movement of material in process or assembly is the most expensive kind as it is usually done by top paid operators and machinists. It is often overlooked; a survey may surprise you . . . Examine carefully the possibility of using completely automatic loading devices which are now available for almost any automatic machining operation . . . See that everyone in the plant is conscious of the fact that handling adds nothing to the value of the product, but it increases the cost to the customer.

Consider trolley and belt conveyors for automatic handling . . . Provide power lift trucks, pallet trucks, and conveyors wherever possible to reduce manpower . . . Include at least one high-lift truck for convenience in stacking and for space conservation . . . Tote pan lift trucks make handling easier; avoid wear on pans and unsightly floors caused by dragging pans . . . Try special tongs for handling bulky materials instead of slings and chain . . . Powered hand trucks take the fatigue out of moving heavily loaded pallets and skids . . . Weighing units are available which weigh material electronically, while it is hanging on the crane hook. This eliminates a separate weighing operation . . . Hydraulic sheet feeding tables keep stock at the correct working and feeding height with a minimum of worker fatigue.

Check the load center capacity of lift trucks before purchasing . . . Don't allow heavy loads to be dropped onto trucks—slide them on, or place them properly with crane or hoist . . . Avoid allowing trucks to be run over pitted or excessively rough floors. A little money spent to smooth aisle floors will save a lot on truck costs . . . Use large-wheel trucks if bumps or rough areas must be traversed. Don't force a truck sideways. Allow it to swing so its wheels are aligned with direction of travel . . . Never permit trucks to be smashed into walls or machines, overloaded or raced. They can take it for awhile—but why should they have to? . . . Inspect, clean, lubricate, and repair trucks on a scheduled plan—not just when something breaks. Again, preventive maintenance will save money.

Selection . . Make an analysis of the need for new equipment or rebuilding of old equipment . . . Check cost figures of products and present equipment . . . Make a conservative estimate of costs, using new equipment . . . Check records for past performance of similar machines . . . Check manufacturer's claims for excessive speeds and feeds . . . Be certain your cutting tools will stand up under these higher load recommendations . . . Make a list of the qualities and facilities you desire in the new machine—select exactly what you need and write it down. Know the horsepower you can use—there is no reason to buy a 50-hp milling machine if 15-hp will handle 99% of your work and the other 1% can be run at reduced feed . . . Contact at least three manufacturers of the type of equipment you desire and make a comparison chart.

Keep in mind the number of pieces to be produced . . . Look for special-purpose machinery whenever you have more than one machine doing the same repetitive work. Usually a multi-spindle automatic machine can be justified if the runs are reasonably long. Attachments may eliminate an operation that will save you more than the price of the attachment in a very short time . . . Select new machines for quality, durability, servicing facilities, proper range of speeds and feeds, and plenty of power for use of carbides; maximum production . . . Consider machines that have some form of tracer or templet control to permit the use of less-skilled labor, to reduce production time, and to minimize scrap . . . Don't buy any machine until you are certain that you have floor capacity for it (running

at full production), and have facilities to put the proper foundation in . . . Avoid buying every gadget that is offered. Analyze each extra to be sure you have definite use for it. Make every part you purchase stand on its own feet as far as savings go . . . Don't limit your thinking to machines "just like the old one". Investigate what competition has . . . Use standard equipment whenever possible unless special equipment can be justified. Don't buy special designs "just to be different" . . . Study catalogs and new tooling ideas carefully and provide as many as possible of the special tools and attachments which you should have . . . At all times—*avoid a hasty choice.*

BENCH WORK

General . . Insert hacksaw blades in frame with teeth pointing away from you. Be sure the blade is perpendicular and tight. Hard-edge blades should be pulled tighter than all-hard blades . . . Saw slowly (40 to 50 strokes per min) with heavy pressure on cutting strokes and lift on returns, and use the whole body, not just the arms . . . Keep at least two teeth of the saw in contact with the work at all times to prevent jamming and breaking teeth . . . Start the cut easily, using the same action as in filing. Apply sufficient pressure to make the teeth cut, and not slip on the metal Scribe a sharp line where the cut is to start.

Use lead or copper false jaws to hold finished work in the vise. For hot work such as soldering, line the jaws with asbestos pads . . . Make sure the vise is securely fastened to the bench . . . Keep the vise screw clean and lubricated, and hold work as near the center of the jaws as possible to avoid springing them . . . Keep chisels sharp, with a long edge for soft metals, shorter edge for hard ones . . . Tap a file on the end of the bench to clear it of chips . . . Rub chalk into teeth when making fine cuts.

Do not perform any bench operations that can be done on a machine unless it is certain that the cost will be lower . . . Where possible, use power hand tools for drilling, burring, polishing and grinding, and see that they are kept in good repair . . . Provide high-quality tools—they are cheaper in the long run.

Insist that all tools returned to the crib be cleaned and oiled . . . Check all tools and gages periodically to be sure they are in good condition . . . Make sure there are sufficient hand tools available.

Every bench hand uses files. Make sure he is using them correctly, that he knows how to file for maximum production and accuracy, and that he is not wasting them . . . Keep all tools sharp and clean. If possible, have a proper drill grinder or have drills reground by someone who knows how. Chisels and punches require retempering after every few grindings or if they are chipped or broken . . . See that benches are kept clean and orderly . . . Provide safety cans for gasoline or other flammable solvents used for cleaning work . . . Traditional methods may not always be the best. For example, bearings can often be honed instead of hand scraped.

Avoid . . a drift punch that is too large or small; one will stick, the other bend . . . Using bent, dull, or bulged-tip punches. They cause accidents . . . Using a warped or twisted hacksaw frame . . . Keeping files in a drawer with other tools. Instead, hang them in a rack or keep them in a file box . . . Applying a bar or wrench to a vise handle to force the jaws tighter —this only causes springing . . . Using a vise for an anvil or cold bending fixture . . . Gripping red-hot metal in a vise. This will usually draw the temper and ruin the jaws . . . Striking, cutting into, nicking, or otherwise injuring or weakening machine vises. The damage will reduce the accuracy of the vise . . . Using a file for any purpose other than filing. Files are hard and brittle and must not be used as pry bars or screwdrivers . . . Never use a file without a proper handle; the first time it sticks it will drive the tang into the user's hand.

BROACHING

Broaching . . Have broaching engineers give thorough instructions in operating procedure . . . Broaches for long runs should be specially treated for surface hardness . . . Broach should return rapidly to its cutting position . . . Multiple broaching operations may be performed in one cycle of the machine. . . . Use machines with variable speed control for versatility . . . Try double-ram machine whenever quantity production is a factor, or when two operations can be performed in sequence . . . Be sure that machine is heavy enough for the job. Gradual increases over a period of time will accumulate until they exceed capacity . . . A broaching force calculator is helpful in fitting machines to jobs and vice-versa . . . Fixtures should be used which may be unloaded and reloaded while cycling . . . Install limit switches to terminate each phase of operation; electric control buttons for automatic cycling of each machine and to actuate each function . . . Avoid solid (alloy steel or carbide) broaches. Detachable shanks, of less-expensive steel, save money . . . Sectional broaches will permit the first section to be removed as wear occurs, and the remaining sections can be moved forward to maintain size . . . Try broaching to eliminate a number of other operations. It will also save floor space by reducing the number of machines required. . . . Free flow of proper cutting lubricant is important . . . Always examine broach and cutterbar teeth for chips, and thoroughly brush these off before starting another pass . . . Watch pressure gage for signs of broach dullness.

HOBBING & SHAVING

Hobbing and Shaving . . You can sometimes produce better gears in less over-all cutting time by introducing a fast gear-finishing operation. This will permit use of multiple-thread hobs, will eliminate separate rough and finish hobbing

or shaping . . . Check whether you can substitute a multiple-tooth gear shear for a number of hobbers or shapers. These machines cut all gear teeth simultaneously, reducing cutting time to about one minute, average . . . Try standard speed reducers for gear cutting, either double or single reduction, instead of built-in gearing. This will save design, engineering overhead, use of special housings, and will minimize machine down-time for special parts . . . Keep moving hob to new position in relation to work to distribute wear evenly . . . Try carbide hobs for abrasive materials such as plastics and fiber. . . . Are you using the most economical gear-shaving method? There is transverse for wide gears, underpass (fastest), or traver-pass, a cross between the first two.

DRILLING

Machines . . Keep clutches, gear trains, elevating screws and similar parts clean and tight so maximum loads can be carried . . . Keep spindles free of backlash and spring . . . If several drills of a size are available, keep the newest and/or most accurate for precision jobs . . . Don't overload a drill and

thus affect spindle precision, but don't underload it by using a small drill (which should run at high speed) in a slow-speed machine . . . If much close-tolerance work is to be done, equip a radial with a spacer table—or install a special machine with such a table. Many jobs can then be handled with only clamping and locating devices rather than a series of jigs . . . Insist that adapter sleeves and taper-shank drills be kept free of burrs so they do not gall the taper in the spindle socket . . . Suit the job to the machine . . . Remember that some boring, honing and grinding jobs can be done with a drillpress.

Drills . . Keep drills sharp . . . Train toolcrib men to issue new drills only for close-tolerance jobs where possible, using older and worn drills for rough work . . . Included angle should be 118° for ordinary steel, up to 135 or 145° if the drill pushes out a bulge as it cuts through . . . In cast materials, included angle can be as low as 60° . . . Lip clearance should be 7 to 9° at the periphery for steels, 12 to 15° for cast iron and soft materials. Too much clearance causes chipping or burning of lips, too little causes splitting and breaking . . . Keep the web thinned to reduce power required . . . Too heavy a feed causes rough holes and chipping, checking or splitting of the drill . . . If chips are curling too much, straighten lip face slightly; if too little, grind in a little more lip rake.

Insist that drills be sharpened with a suitable fixture or on a suitable machine, and checked by gage afterward. A drill that is improperly ground drills an off-size and frequently off-shape hole, is overloaded and quickly ruined . . . Remember that a drill is the most heavily loaded, and least supported, cutting tool . . . Honing or oil-stoning a reground drill will lengthen time between grinds, insure cleaner holes, reduce drill burning and breakage . . . Have the drill grinder in the tool crib, permitting checking and resharpening during slack periods . . . Train the sharpener to avoid overheating and burning or sudden quenching.

Be sure a drill shank is clean and free of nicks before it is inserted in chuck or spindle, and that the tang has no edge burrs from previous drifting . . . Drills with broken tangs can be fitted with special sleeves to make them usable . . . Do not allow drills to strike the work or table in service or when being removed, nor to be jammed into a hole . . . Don't start a drill on a sloping surface without a close bushing to support it or a center-drilled hole to guide it . . . Don't reduce shank diameter so a larger drill will fit a smaller chuck—a ½-in. drill, for example, requires four times the driving power for a ¼-in. one, and the chuck may be ruined . . . When a drill burns or breaks in a hole, clean the hole before power feed is reapplied . . . Remember three-flute drills, oil-hole drills and other specials for special jobs. Carbide-tipped drills are also available.

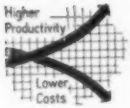
REAMING

Reamers . . Reamers must be square and aligned with the hole, or they will bind and break, or distort the hole . . . The reamer must be solidly seated and supported and the spindle tight; chatter will ruin both reamer and hole . . . Don't jam a reamer into a hole, unless it is made for such treatment . . . Keep a reamer flooded with coolant, if necessary, to keep it cool. Burned or chipped edges ruin it . . . Run reamers at slower speeds and higher feeds than drills of the same size. H.S. reamers run at 3/2 to 4/3 drill feed, varied of course to suit amount of material to be removed and finish desired. . . . On some materials—like tough alloys—the reamer must cut or it will burn; it cannot simply scrape hole walls.

For extremely accurate, smooth holes, a carbon-steel reamer may be better. For tough material and production reaming, H.S. or carbide reamers are better . . . Regrind reamers with a fine, but free-cutting wheel and keep them cool to avoid burning. Finish by honing if high accuracy and smooth finish are desired . . . For reaming taper-pin holes, hand reaming may be best, but guide the reamer with a center set in the drill spindle . . . Never force expansion reamers beyond their capacity.

Chucks . . Don't tighten key chucks with a wrench or with an extension on the key. Bent keys, broken teeth and sprung jaws are the certain

result . . . When sleeve or keyholes become too badly worn, replace sleeve or chuck . . . Keep chucks oiled and free of nicks . . . Don't attempt to grip a short or broken drill tightly; the jaws will spring, ruining the chuck and causing inaccurate drilling . . . Avoid overloading, dropping the chuck on its jaws, or pounding the chuck out of the spindle; all result in broken or bent chuck parts . . . Be sure drills or reamers are gripped securely, because slippage chews drill shanks



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and wears chuck jaws, causing inaccuracy and reducing chuck gripping power . . . Reserve new chucks for precision jobs where possible. . . . Remember quick-change chucks for production jobs.

Coolants . . Keep coolants clean . . . Use special fluids for special jobs, for example, kerosene or carbon tetrachloride from an oilcan in drilling tough steels, but don't let such fluids contaminate the normal coolant . . . Insist that operators take proper precautions (adequate

creams and germicidal washing) against dermatitis and that scratches and cuts be cleaned and protected at once . . . More coolant is the answer if outer corners of drills break down or burn.

General . . Multiple-spindle machines or multiple heads can do several drilling and reaming jobs at once . . . Drill heads can work at any angle or even be installed on other machines . . . Jigs should be self-cleaning, or readily cleanable to prevent fouling with chips and resultant inaccuracy or insecure clamping . . . Remember air and quick-action lever or cam clamps.

MILLING

General . . When milling steel, try negative-rake carbide cutters to achieve faster feed rates together with higher cutting speed . . . Modern milling machines will withstand short-duration overloads without overheating the motor, so feed the table as rapidly as possible without causing chatter or cutter damage . . . Use automatic work loaders on production jobs in order to cut down cycle time . . . Air clamps in work fixtures cut cycle time as much as two-thirds, when milling bulky castings . . . Climb milling is best if equipment permits.

Can you reduce the time of the milling operation by substituting a surface broach? . . . Employ double fixtures wherever possible.

Be sure feed and speed are right . . . Remember the greater the feed per tooth, the more efficient is the metal removal. Stay within cutter strength and get desired finish, but don't reduce feed too much—that causes teeth to slide and dull prematurely . . . If the cutter vibrates, check first for loose supports, then for too great clearance on the cutter.

With ductile materials, use rake-tooth cutters if possible. Aluminum requires large rake angle on teeth, soft brass requires radial cutting faces. For deep cuts in ductile steels, provide rake, because chips tend to wedge . . . If the cutter "hogs in", rake is probably too great. This is particularly dangerous if work is thin or machine light.

Facing milling is preferable for large plain surfaces . . . Slab-milling, because of its high metal-removal efficiency, is preferable on narrow steel sections . . . Keep slab-milling cutters small in diameter, their arbors large. For simple shapes, use profile cutters; for complicated ones use form cutters.

Use inserted-blade cutters in large sizes, or for special-material cutting edges, providing cutter thickness and load permit . . . Be sure plenty of coolant is being supplied, particularly on steel and wrought-iron and on saws . . . Avoid feeding end mills at rates over 2/3 those on ordinary cutters, to avoid bending strain. On deep-slotting, use coarse-pitch cutters.

Wide slits deep into hard materials require slitting saws with side teeth . . . Alternate-tooth saws eliminate vibration and keep the cut straight . . . For thin materials, use fine-pitch saws to keep more than one tooth in the work. . . . Dull cutters and saws break: keep them sharp and running true.

Cutters . . In face milling on light alloys, economy is obtained by using special cutters with fewer inserted teeth . . . If one is a roughing tooth, and another the finishing tooth, excellent surface finish is obtained, avoiding variations from multiple-blade contact with work . . . Use a single chamfer on face-mill blades, especially if carbide-tipped, to avoid chip-flow troubles and wear of sharp corners . . . Less metal must be ground from the blade, if you specify chamfers of 30 or 15°, instead of the common 45° specification.

Set up a system whereby cutters with wrong rake angles will not be used . . . General rules for rake angles are: 10 to 15° on high-speed-steel cutters used on steels and 25° or more on light alloys; about half as much rake on cast-alloy tools for same purposes, and 5 to 10° negative rake on carbide tools for steel and 10 to 20° on non-ferrous materials.

Check the tooth load, or chip thickness, and do not exceed recommended tooth loads for cutting-tool material . . . Establish a system, perhaps a tag tied to cutter, whereby carbide cutters are ground with correct cutting and clearance angles . . . Avoid using cutters with over 60° spiral angle; they cause inthrust, wear spindle bearings and table ways.

Mounting Cutters . . Before placing cutter shank or arbor in spindle, clean the tapered surfaces and inspect for nicks . . . Check to see that the tapered shank of arbor or cutter makes contact throughout the length of the taper . . . The arbor diameter should fill the center hole of hole-type cutters . . . If the arbor overhangs the outer support, chatter may result . . . Mount cutters as close to the column as possible to reduce arbor spring . . . Handle spacing collars and bearing collars carefully and see that they have a sliding fit on the arbor . . . Tighten the arbor nut only after the arbor support is locked in relation to the cutter.

GRINDING

General . . To reduce grinding time, fit grinding-wheel specifications to the job . . . If wheel is too fine or too hard, the grinding cycle is longer than it should be and cost

is correspondingly higher . . . Use a wheel of correct hardness, because an excessively hard wheel requires frequent dressing, thus wastes time, diamond nibs and grinding-wheel material.

Check the complete grinding procedure . . . See if the work speed, depth of cut and rate of traverse can be increased to reduce the grinding cycle . . . Determine the optimum number of pieces that can be ground in one dressing and dress regularly to this schedule . . . Make sure that the diamond is of the right carat size for the size, grain and grade of the wheel . . . Apply the diamond to the wheel at the correct drag angle of 30°.

Reduce the amount of stock left for grinding by improving finish from preceding operation . . . If part is hardened, improve heat-treatment if necessary, to avoid excessive stock allowance to take care of distortion.

Coolants . . If grinding is done wet, use right coolant and mixture . . . Change coolant before it becomes excessively dirty . . . Use a thin grinding solution of right type to keep wheel clean and sharp by washing chips away . . . Consider feeding coolant through an open-structure wheel . . . Equip the grinder with an efficient filter that is easily cleaned . . . Try air-blast in deep holes where coolant is difficult to apply.

Grinding Wheels . . Store grinding wheels in suitable drawers, racks or bins to avoid breakage . . . Run new wheels at full operating speed for at least one minute before applying work . . . When dressing wheels, turn the diamond often to keep it sharp and maintain uniform wear . . . Maintain good cutting action and prolong wheel life by increasing wheel rpm as the diameter wears down . . . If the wheel face glazes and loads, increasing the work speed will improve the cutting action.

Cylindrical Grinding . . Minimize spindle wear by wiping out the spindles before inserting headstock and footstock centers . . . On long, slender work use steadyrests about 1 ft apart for work under 3 in. dia to prevent the piece from vibrating . . . Try a coolant filter to produce high finishes on work, especially alumnium alloys . . . Investigate the possibility of using automatic sizing . . . This is easy to set up and will materially increase production over manual control.

Centerless Grinding . . Match the hardness of the blade material to work material and length of run . . . Use cast iron, high-speed steel, cast alloys or cemented carbides as indicated by blade requirements, and choose blade angle carefully. . . . Improved automatic loading devices will greatly reduce cycle time for centerless grinding.

Internal Grinding . . Choose the shortest and most rigid quill that will operate satisfactorily in the hole . . . Employ a quill that permits wearing down the wheel sufficiently for economy . . . Adjust work speed between 150 and 200 sfpm to control cutting action of wheel . . . When feed lines are seen on the work, redress wheel and reduce wheel feed on final passes.

Surface Grinding . . Use non-magnetic straight edges for checking flatness and parallelism on large plates held on the magnetic chuck.

Tool Grinding . . Use centralized tool grinding . . . Allowing operators to sharpen their own tools results in important losses of productive time . . . Scrap losses due to incorrect tool sharpening can be cut sharply by centralized control.

AVOID THIS—

General . . Spoiled work is caused by burning or cracking, caused by a wheel that is too fine or too hard or by improper technique . . . Don't let rejections rise by improper maintenance of machine . . . Recondition or replace worn spindle bearings, work centers and other vital parts . . . Don't allow haphazard lubrication of the machine.

Avoid vibration in quills and spindles; the general rule is a length-to-diameter ratio of 4:1 . . . Beyond that, use a damped quill if necessary, and above 7:1, a damped quill must be used . . . Eliminate downtime caused by failure of accessories such as centers, quills, rests, pawls by using hard materials . . . These parts are now being made of cemented carbide.

Grinding Wheels . . Do not bump grinding wheels, or roll them hoop fashion, because invisible cracks may cause them to fly apart when put in service . . . Avoid extremes of temperature in storage rooms for wheels . . . Do not mount wheels of larger diameter or thickness on spindles smaller than recommended in safety code . . . To avoid breakage do not force work against a cold wheel. . . . Be careful about grinding on the side of the wheel.

Cylindrical Grinding . . Don't let the coolant tank become filled with sludge, or the finish will suffer . . . Damage may be severe if an improperly applied driving clog comes loose, and the work spins at high speed, burns off the center points and flies out of the machine.

Centerless Grinding . . Chatter marks arise from grinding too high above the centerline of the wheel. . . . On the other hand, do not decrease the height above center too much, or the work will be out of round.

Internal Grinding . . Avoid excessive stock, also rough or out-of-round conditions in holes, because grinding costs will be raised . . . Prevent grinding a taper hole, by causing wheel to withdraw equal amounts from each end of open holes . . . Don't use bushed wheels, because they are likely to be out of balance . . . Never run an old V-belt with a new one; employ matched sets of belts to avoid creeping action.

CHECK THIS—

Grinding Wheels . . Inspect wheels for injuries and soundness immediately upon receipt . . . Test wheels in service for balance at intervals . . . Have you checked the wheel-mounting practices in your shop and the condition of the hoods?

Cylindrical Grinding . . See that wheel speeds lie between 5500 and 6500 sfpm and the work speed about 100 sfpm for normal jobs . . . Is the coolant applied copiously, and is it of proper type and consistency? . . . Check that angle of centers in the work matches angle of work center points . . . See that taper of work centers fits work-spindle tapers . . . Keep dirt off

work centers and out of center holes in work spindles . . . Check that both centers in the work are uniform in depth. Variation will cause inaccurate grinding and require more frequent truing.

Internal Grinding . . Are inaccurate locating surfaces on work causing distortion in fixture and poor holes? . . . Make certain that the grinder rests on a solid foundation and is properly aligned . . . Make frequent check of wheelhead belt slippage and wear . . . For high accuracy, control temperatures of room, coolant, lubricant.

HONING AND LAPPING

Use honed holes for accurate location of work in process on arbors . . . Consider internal honing as both a hole-correcting process and a stock-removing method . . . You can eliminate a finish-boring operation in some cases and take out up to a 1/16th on the diameter with honing . . . External honing is being rapidly adopted for obtaining desired dimensions and finish . . . With dial feeds on machines, external honing is a high-production method of keeping parts within close limits.

Resort to lapping for fine surface finishes and flatness . . . Lapped surfaces save use of gaskets, give better seals, save assembly time . . . Choose the correct grade of close-grained iron for solid laps . . . Charge them with accurately graded diamond powder to achieve uniformity in depth of scratch . . . Machine lapping is a high-production method of obtaining flat, highly finished surfaces . . . Many small parts can be loaded on the machine table at once, giving economical cost per piece . . . Very large parts can be lapped cheaply to an oil-tight scaling face, despite many interruptions on the surface.

PLANING AND SHAPING

Planing . . Have you provided an adequate number of T-bolts, straps, clamps and jacks at each machine,

or must operators hunt for "furniture" when setting up jobs? . . . Are your fixtures equipped with targets to establish height of surfaces without measurement from the table? . . . Do you use layout fixtures in advance of planing, to equalize cuts and make sure surfaces clean up?

By rigging up a two-speed table drive ,an old planer can be made to mill as well as plane, thus saving a setup . . . Have you thought of spotting a portable boring machine next to the planer table for drilling work on the table? . . . Side heads can be tilted and caused to feed in or out by an accessory drive while planing an angular surface at same time railheads work on horizontal surfaces.

There is a jump-cutting attachment, whereby obstructed surfaces can be machined without inching the table . . . This device can be used on boring mills too . . . Examine the metal-removing capacity of existing planers in comparison with modern machines that plane at up to 300 fpm with carbide . . . Save the time of expensive large planers by milling small pads on bulky work by means of a side-head mill.

Do you train operators to support work properly by use of jacks and dial indicators to check sag at scribed centerlines . . . Try low cost wood templets for setting up rough castings, because this is faster than using a surface gage.

Shaping . . Clamp tool and material securely and with minimum of overhang . . . Try broaching instead of shaping complex contours . . . Where applicable, surface broaching offers high production at low machining cost per part . . . Modern shapers operate at faster speeds than those made a few years ago. Can you compete?

Check ram gib for proper adjustment . . . Also check other gib adjustments according to need . . . Inspect moving parts for scratches.

Does operator store material in efficient manner? . . . Check direction of rotation of motor and voltage . . . Use carbides, tool lifters, tracer control, and other modern equipment available on shapers.

FLAME CUTTING

Save time on cutting thin plates by stacking and clamping tightly . . . Ordinary clamps are not suitable, but try using squeeze riveters as clamps . . . Estimate weight of flame-cut part by weighing a paper templet and proportioning weight of 1 sq ft of paper to 1 sq ft of metal . . . Prick punch every ½ in. along line to be cut to improve visibility . . . Use correct gas pressures for thickness of plate to be cut . . . Bevel plate edges with a torch . . . Flame cut holes in aluminum or brass by first painting the surrounding area with quick-drying iron cement . . . Place a pan of sand or water under the cut to catch the hot metal and prevent accidents . . . Use support work on the corners of angle iron strips during cutting. The area of contact is so small that the supports are usually not damaged during the operation . . . Use flame gouging as a substitute for chipping and grinding . . . Store nozzles in holders to protect the ends . . . Inspect all joints and connections for leaks at frequent intervals to minimize losses.

AVOID THIS—

Don't use ordinary drills for cleaning nozzles; use special cleaning tools . . . Don't throw nozzles in drawers or boxes . . . Avoid kinks or abrasions in hose. Carry it—don't drag it along the floor . . . Never repair hose with tape. Cut out damaged sections and insert a coupling . . . Don't clean greasy hose with solvents or caustic cleaners, they will destroy the rubber . . . Never leave a torch burning when not actually in use . . . Don't test for leaks with a match—use soapy water . . .

SAWING

Machines.. Modern power hacksaws cut much faster and straighter, reducing grip and facing waste of expensive materials to be machined later. Do your power saws measure up? . . . Are you doing cut-off operations on millers, lathes or screw machines that should be done on a hack or circular saw? . . . Are you providing hand hacksaws for operations where machines would save money? . . . Steels and non-ferrous metals can be friction-sawed (large sections and quantities with a circular machine, small sections and contours with a bandsaw) far faster than by conventional units . . . Abrasive-

disk saws cut without burr . . . Circular saws may save tool costs and time over abrasive wheels on thin sections, extrusions and structural shapes.

Blades.. Keep blades tight and sharp; dull and loose blades wander in the cut, heat up and thus wear faster, give a rough finish . . . Suit number of teeth to the material and cross-section, speed and feed to material . . . Avoid over-feeding and be sure the blade is inserted and started properly . . . For hacksaw blades particularly, be sure blade is thick enough, wide enough and of proper length.

Bandsaws.. When putting a blade on band wheels, set it so the teeth project a little over the edge or, if there is one, over the recess in the flange. Then set the guides, lower guide first, so they just touch the back of the blade running free . . . Side rolls of guides should be adjusted to hold the blade in alignment for straight cutting . . . If guide plates are used instead of rolls, they must be adjusted so the blade passes through freely . . . Don't jam the blade in a tight curve or sharp corner . . . Be sure bandwheels are aligned . . . Clean bandwheels frequently; don't allow grease or dirt to form lumps on them. Sandpaper will take lumps off . . . Don't crowd the saw . . . For circular sections 5 to 18 in. in dia, saw in an automatic fixture. Such a unit will save setup time, give a smoother cut (seldom needing additional machining). It has an automatic feed.

Hacksaws.. If hacksaw blades cut crooked, they are loose, the saw frame is out of line with the vise, the stock is loose, the set is worn off one side of the blade, feed is too heavy ,or the blade is worn out . . . Breakage of blades is caused by overfeed, starting on a sharp corner, dropping the blade on the work, or too coarse a blade . . . A blade with insufficient set will bind . . . Check work for hidden spots or foreign material before sawing . . . Excessive wear is caused by too low a feed, slipping belt, too fine teeth for the stock, frame not lifting on return stroke, blade in backward, insufficient (or improper) coolant, or machine in need of maintenance . . . Start with low feed, until the work "skin" is cut through, particularly with a new blade . . . Coolant should be started before the saw starts to cut, and kept flowing until the saw stops . . . If no coolant is used, operate at 20 strokes per minute.

General.. Be sure guards are in place on band and circular saws . . . Every piece of a group must be held firmly, or the saw will wander or break. Special fixtures can be made to hold each piece of a series separately for multiple cuts . . . In sawing thin cross-sections, a hard grease, wax or paraffin stick applied to the sides of the blade every 2 or 3 min may make coolant unnecessary, reducing mess and cleaning costs. However, a generous flow of coolant is recommended for solids and heavy-gage cross-sections.

TAPPING AND THREADING

On tough tapping jobs, try a little carbon tetrachloride applied from an oilcan . . . Use leadscrew tappers for really accurate work, especially in soft material . . . Spiral-flute taps sometimes simplify aluminum tapping jobs . . . When production volume justifies the expenditure, it may be cheaper to use a tapping machine than a drillpress . . . Broken taps can be removed by electric disintegrating, but make sure the cost of this does not exceed the value of the job . . . On cast iron use lard oil as a lubricant, on hard or tough materials a sulfur-base oil is best, on softer materials use lard oil or soluble oil . . . For large, coarse threads, use double-tool cross slide and rough out first with back tool; then finish one side of thread at a time with front tool.

Use threading dial on long threads instead of reversing lathe . . . Use a formed threading tool wherever possible . . . Use die mounted on lathe carriage and driven by leadscrew of lathe to produce threads with more accurate lead than can usually be obtained with a die. This is faster than chasing with a single-point

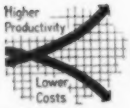
tool and almost as accurate . . . Use a dieholder assembly in a tapping attachment to utilize a drillpress instead of tieing up an expensive tool for external threading jobs . . . Set cutting tool 1/32 in. above centerline of work if threads are rough . . . For 60° threads, feed tool in at 29° instead of straight in.

AVOID THIS—

The necessity for retapping at assembling by making sure the first tapping is big enough . . . Hand tapping is expensive, avoid it except where essential . . . Blind tapped holes if through holes can be used just as well . . . Don't use precision ground taps for class 2 fits. Commercial ground taps are cheaper and are usually adequate.

CHECK THIS—

Make sure there is adequate bottom clearance in blind holes . . . Use the correct surface speed for the material being machined . . . Be sure the correct tap-drill size is specified . . . Is there an undercut or sufficient chaser clearance at the end of external threads? . . . Recheck the OD before cutting threads. Stainless steel should be 0.005 in. smaller in dia than nominal thread dia . . . Inspect all new taps when received to be sure PD is correct . . . Keep threading tools sharp . . . Be sure there is sufficient lead on taps and chasers.



Cost Cutting Clinic

TURNING AND BORING

General . . Look around for opportunities to raise speeds and feeds on existing jobs; you may find plenty . . . Try a better coolant such as sulphurized oil, lard oil or

air blast . . . Employ multiple cuts, performing as many elements of the operation at one time as possible . . . Have you looked at jobs where one operator can operate two or more lathes, especially when long cuts are taken?

Angular surfaces may be turned in production quantities by disconnecting the turret cross screw and allowing the cam follower to feed against the cam on standard turret lathes . . . Try changing materials; in one case a crankshaft originally turned from bar stock is now forged, and the machine-time saving is 4 hr . . . Have standard tools ground and lapped to exact specifications in the toolroom rather than leave this to the operator.

Boring Bars . . Often faster cuts can be made by using a larger boring bar or larger bit . . . Provide a good selection of bars in respect to both sizes and lengths . . . Set bars in advance to the sizes needed, to eliminate adjustment, reduce chatter, permit deeper cuts, and allow higher speeds with heavier feeds. . . . Try an auxiliary support for the boring bar, such as outboard bearing, backrest, or a bushing in the spindle.

On high-production jobs use interchangeable quills with preset tools . . . Use hardened boring bars and hardened pilot bushings . . . Cut left-hand spiral oil grooves in bushings to retain lubricant while the bar is revolving . . . Equip bushings with annular rings so lubricant is pumped back to oil-circulating system.

Chucks . . Save cost of center drilling by centerless mountings for work, such as collet chuck or lathe chuck on headstock and adjustable chuck on tailstock . . . Try special work-holding fixtures that provide better support and afford quicker location than standard chucks . . . On short-run jobs use soft jaws wherever possible.

Try a quick-acting chuck, such as a lever, air, or hydraulically operated one to reduce chucking time and operator fatigue . . . Equip air chucks with air-pressure releases to bring down the gripping pressure for finish-boring, thus minimizing out-of-round conditions . . . Remember that, if loading time is less than 25% of total cycle, it is doubtful if additional cost of hydraulic or air clamping is justified.

Cutting Tools . . Use standardized grinds, sizes, shapes and grades of turning and boring tools so the number of varieties is kept to a minimum, to cut both inventory and cost of adapting tools to boring bars and toolholders . . . Remember that a larger-size cutting tool will carry heat away from the cutting edge better.

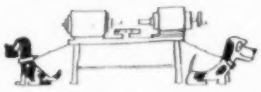
Maybe you should be using super alloys or carbide on some jobs . . . Try clamped-on carbide toolbits, because these permit the use of a harder grade carbide and you buy only the bits . . . Consider the advantages of roughing out with a core drill or double-edged boring cutter, and finishing with a single-point tool . . . Reduce downtime for tool replacement by use of simple tool-setting gages.

Mandrels . . Use expansion mandrels to save time, but also try quick-acting rolling lock mandrels . . . Check the length of the mandrel used; it should be as short as possible for the job . . . Give operators two or more mandrels so one can be loaded while the other is in use . . . Load gear blanks two or more at once on a mandrel preparatory to turning the OD.

Machine Attachments . . An automatic mechanical feed for bar stock saves much labor, keeps the machine running a greater portion of the time . . . When hubs of large irregular or unbalanced parts are to be bored and faced, try using a tool-slide or facing head on the spindle, while the part is held in a stationary fixture.

For moderate production or frequent change-overs, good results can be obtained with a universal fixture with interchangeable locators for holding either work or tools . . . Single or multiple stops will speed tool positioning; an automatic carriage stop saves time.

Provide supplementary work support such as a center rest and follower rest to permit taking heavier cuts . . . Supply two or



more lathe dogs with each lathe, so that the operator can attach one to the work while the other is in use . . .

Use a driving-dog faceplate instead of lathe dogs . . . Try eccentric keys to align drilling operations. Low-gear ratio is used for drilling with little effort to turn handwheel; high-gear ratio is employed for fast travel of spindle for loading and unloading.

Long cuts are better handled with a ball-bearing live center in tailstock . . . Investigate templet-copying attachments to speed up contour turning operations.

A sliderule type speed-index plate will indicate rpm for sfpm necessary to machine the given diameter at maximum safe horsepower . . . To see whether full horsepower or machine capacity is being used, attach a hp-indicating meter to equipment.

Machine Selection . . When machining time is major part of total time cycle, production time per operator can be reduced if the machine will accommodate additional spindles.

Avoid use of jigs by selecting equipment that will bore and face at precisely indexed stations, and to a high degree of accuracy, but remains flexible for product changes.

Records . . Keep a record of lost machine time and carefully analyze the reasons . . . Maintain records of tool life and from them determine if cutting tool is properly shaped and ground.

CHECK—

Chucks . . See that the chuck wrench fits the chuck properly, that chuck jaws fit the slots snugly. . . . Chuck mounting should be substantial and close-coupled.

Mandrels and Boring Bars . . Is the center hole in mandrels of the proper size? . . . When boring holes having a high ratio of length to diameter, a solid tungsten-carbide diameter boring bar will eliminate bar windup and provide straight concentric holes.

Machine Modifications . . Check to determine whether increasing the number of spindles and work stations will increase efficiency . . . Have you considered the possibility of mounting work on the carriage and the boring bar in the spindle or between centers? These changes permit higher cutting speed and coarser feed . . . Can broaching be substituted for boring to reduce machining cost?

AVOID THIS—

General . . Avoid asking for closer tolerances and removing more stock than is necessary . . . Don't ask for two cuts when one will do. . . . Have you asked for better finish than is required? . . . Avoid cutting speeds that shorten tool life too much; it is better to use a heavier feed . . . Do not grind tools so they produce long, stringy chips; use a chip breaker.

Chucks . . Unnecessary overhang of chuck or work creates chatter; the chuck should be as close to spindle bearing as possible . . . An oversized chuck is slow to start and stop . . . Chucks are more expensive than ordinary fixtures, more difficult to load and require time for starting and stopping . . . Avoid chucking whenever it is possible to use a serrated or "brinell" type workholding method instead.

Accessories . . Avoid machining a large part on a small-diameter mandrel . . . Unnecessary overhang of boring bar reduces permissible machining rate . . . On long precision bores, avoid maintenance costs of piloted boring bars, when possible, by the use of deep-hole-type, extended-body spindles.

TOOLING

Machines . . Provide enough horsepower to handle both immediate and expected cutting loads . . . Wattmeters help in loading machines to capacity . . . Large openings and adequate room for chips are essential, plus properly angled chutes and chip conveyors where chip disposal might take operator time . . . Odd drilling, grinding or slotting jobs can frequently be done during other operations by mounting a suitable head on a basic machine tool . . . Don't forget combination machines, such as the horizontal boring, drilling and milling machines, transfer and shuttle combinations, way drills, and the like . . . Also consider the potentials of added spindles to multiply machine output per man and per unit of floorspace.

Tools . . Have standards for tool angles, feeds and speeds and see that they are followed . . . On multi-tool machines, use toolholders in which bits or cutters can be set to gage in the toolroom. Switching toolholders is fast; stopping to grind and reset tools is costly . . . Avoid special tools . . . Don't attempt to use carbides on machines without the power or rigidity to handle them at a uniform cutting speed. Carbides also are unsuited for interrupted cuts unless special precautions are taken. They are very well suited to cutting soft but very abrasive materials like paper and plastics, and to producing high finish at high speed. Wherever possible, use standard carbide shapes rather than specials, to cut original cost, inventory, "dead" storage and special tool dressing . . . Maintain proper adjustment and keep tools sharp.

Jigs and Fixtures . . Check for easy, fast loading and rapid, positive clamping that does not distort the part . . . Keep fixture weight down if it must be moved . . . Allow adequate chip clearance and provide for coolant *at the cutting point* . . . Use wherever possible swivel or sliding jigs, dial plates and/or feeding devices to cut machine downtime . . . Have the fixture guide or support the tool if possible . . . Have standards for jig and fixture elements and use standard parts to cut inventory and avoid complications . . . Try to design fixtures to handle several parts . . . If carbides are to be used, provide extra rigidity in the jig . . . Compare the advantages of jigs with those of the hole spacer, profile follower and similar automatic or semi-automatic guiding or locating devices . . . Compare cost and relative time for cast and fabricated jigs.

General . . Be sure operations are in economical sequence . . . Designs should incorporate locating points for use in all operations . . . Reversible and renewable gages are an economy, just as are hard-material gages for heavy or abrasive service . . . Dial indicators will speed setups involving linear motion . . . Powered portable tools will usually beat hand tools, pay for themselves in phenomenally short time. Included are chucks and vises . . . Put tool inspection and maintenance in competent hands to cut replacement costs . . . Provide balancers or other devices

to take tool, part or fixture loads and reduce operator fatigue . . . Wherever new tool types are involved, be sure every operator receives detailed instructions in their care.

See also the tooling suggestions for individual operations.

CASTING AND SINTERING

Castings . . Instead of castings consider the possibility of using weldments. These reduce the machining required, are lighter, and have a lower scrap potential . . . Employ inserts whenever their use attains results that cannot be realized at equal cost by other means . . . Cast to minimize trimming costs . . . Try pointed cores to spot holes which are to be drilled later . . . Allow ample drafts, both on cavity walls and on cores . . . Studs formed as an integral part of the casting usually cost less than inserted studs and, in general, constitute a highly economical means for fastening

casting to a mating part. Of course, integral studs should not be so small in diameter as to be fragile or easily damaged in handling . . .

Cores help to keep section thickness relatively uniform, also provide holes accurately sized and precisely spaced . . . Try casting threads directly on integral studs, even if it is necessary to chase them afterward, cost is reduced . . . Remember that even the smallest fillets have an appreciable strengthening effect. They minimize the chance of cracking and improve finishing . . . Keep section thickness to a minimum consistent with ease of casting and with adequate strength and thickness. This provides stronger sections in proportion to thickness plus rapid cooling, resulting in better finish and higher production rates.

Try chrome plating tools to be used for machining zinc die-castings . . . Keep size at a minimum consistent with all other requirements . . . Although ordinary hardened high-carbon steel tools are satisfactory for die-castings, try high-speed steel, stellite and carbide tools. They will effect savings through fewer tool changes, more rapid machining, less tool grinding time, and superior finish. This is particularly true for long runs, but where general purpose carbide tools can be used, they offer advantages even on short runs . . . Take advantage of the ductility of zinc casting alloys by designing

parts for bending or forming after casting . . . Die-cast parts in multiple units using a combination die wherever conditions permit. Use "unit" dies wherever you want the production advantage of combination dies plus individaul control . . . Check that die parting comes at the maximum casting diameter.

AVOID THIS—

Designing special carbide tools for die-casting jobs having less than 25,000 pieces. Although this number may vary with the character of the work, it is usually poor economy to design special tools for a job with fewer pieces . . . Plain flat surfaces of any considerable area as they lead to high rejections and increased costs. It is suggested that they be curved or crowned—or be broken by beads, steps, or low-relief . . . Overlooking any opportunity to add ribs to thin wall castings for strengthening . . . The use of undercuts except where advantages offset disadvantages—and that is seldom the case . . . Locating ejector pins in casting dies at places where they leave objectionable marks on the finished casting . . . Distortion by keeping sections uniform.

Using studs when tapped bosses are suitable. These are always preferable and sometimes as economical as threaded cast stud.

Powder Metal . . Metal powder compacts offer faster production rates and wider material variations than die cast or machined parts. Analyze your product for parts where these will reduce costs . . . Use high speed presses, automatic feeds and ejectors . . . Keep oil and powder clean and free of moisture . . . Analyze mixture regularly to maintain uniformity . . . Use automatic furnace controls, but check manually every day for accuracy . . . Do not use furnace for anything but sintering to avoid contamination . . . For high temperature work investigate use of traces of chemical catalysts in furnace atmosphere or batch to speed process . . . Look into possibility of welding high temperature compacts that fracture—it is being done now . . . Call on powder manufacturers for help and advice in planning manufacture.

ELECTROFORMING

General . . Try electroformed parts, when products are too costly or can't be made by other processes. . . . Electroforming involves electro-deposition of metals onto a reusable or fusable matrix, and stripping the resultant shell from the permanent matrix or melting out the expendable matrix . . . Parts made include: from sleeve journals for watch-second hands to 5-ft. reflectors.

Matrices . . Don't overlook the importance of the matrix . . . Dimensional accuracy and surface finish of the matrix determine quality of the electroformed product . . . Remember that rounded corners are desirable on matrices, that slight tapers are desirable on cores.

Tolerances . . Besides a surface duplicating that of the matrix, you can expect OD tolerances of ± 0.001 in. with permanent mandrels and ± 0.002 with fusible matrix materials . . . But extreme accuracy, say ± 0.0002 in., has been secured on electronic parts . . . Look to custom suppliers of electroformed parts, whether you need items on a production basis or merely a facing for a low-cost mold . . . They know the arts and crafts involved.

Plating Operation . . Make the matrix conductive by a graphite film, then deposit thin copper or silver . . . Commercial electroforming involves shells of iron, copper, nickel, chromium or silver, either singly or laminated.

FORGING

Furnaces . . To reduce scaling, keep flame slightly reducing, keep furnace tight, use automatic temperature control and efficient burners . . . Scaling can also be reduced by

providing auxiliary burners, set to reducing flame, which go on at the door when it opens . . . Induction heating will eliminate scale, thus saving material and dies, as well as time because of its speed, but it is costly, and requires changed worked coils for each job . . . Also, partially heated pieces cannot be reinserted without danger of melt-

ing . . . Try making a small furnace portable—to handle short-run jobs at any forging equipment in the shop . . . Air jets can be used during forging to blow off scale, but should not be used in furnaces or before the work has cooled below 2400 F, or they will cause burning.

Dies . . For large or complex forgings, or high-production jobs, alloy-steel dies will last longer . . . To increase die life, keep die temperature down by removing forgings promptly and by air blast or water cooling, by blowing out scale each cycle, by maintaining alignment, and by providing high polish and hard surfacing at points of greatest wear . . . Preliminary forging—edging, fullering or blocking—will save wear on final dies, as well as time, material and machining . . . For quantities under 1,000, consider flat dies and stock tools . . . Preheat dies before forging by gas flame or a heated block between them; dies frequently wear faster than necessary because of failure to preheat . . . A little swabbing with oil will reduce the sticking of forgings in finish dies, but keep it at a minimum.

Machines . . Don't forget that trimming and punching attachments may be incorporated on forging machines, so forgings can be finished hot . . . By allowing a sprue hole at the die back, flash can frequently be avoided at die joining lines. The sprue is easily trimmed . . . Fullering on a trip or helve hammer may sometimes make a part adaptable to drop-hammer production . . . Extrusion can be done in a forging press . . . On large pieces, reheating will save dies and possible spoilage if major forging is to be done . . . Machines must be kept clear of scale, dirt and carbonized lubricant.

General . . Alloy steels, in particular, can be sheared to forging length hot, if ends need not be square . . . Very large billets can be torch cut . . . Surface defects should be removed at once, so they do not work into major faults . . . Heavy forgings must be cooled slowly, usually followed by furnace annealing and possible normalizing. Otherwise, core faults may develop . . . Preheating of alloy steels will retard scale formation . . . On brasses and bronzes, avoid cracking of fins; the cracks may extend into the piece.

METAL SPRAYING

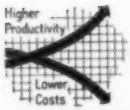
Try using sprayed metal for building up worn machine parts, but don't use it where it will be subject to rolling action, as on wheel rims, or to sharp impact, as on gear teeth . . . Mis-machined parts and castings which have surface imperfections can often be salvaged by applying a coat of sprayed metal . . . Make shafts from low-carbon, easily machined steel, and add a coat of hard steel only at those areas where wear resistance is needed . . . For corrosion resistance, make part of low-cost material and apply a coat of bronze, Monel, nickel, or other corrosion-resistant material . . . Protect iron and steel from the effects of high temperature by coating with aluminum . . . Non-metallics such as plastic and rubber can be sprayed with regular metal-spraying guns to form corrosion-resistant parts . . . To solder metal to glass, spray the glass with a coat of aluminum and then apply a coat of copper . . . Hard surfacing can be applied by spraying the material onto the base metal, then fusing it with an oxyacetylene torch, induction heat, or controlled-atmosphere furnace . . . For quantity production, use fixed or movable spray guns in combination with conveyors or turntables.

Before spraying, prepare surfaces carefully. The success of the operation depends entirely upon this . . . Surfaces must be rough enough for metal particles to lock themselves mechanically into crevices and irregularities, and must be free of oxides, grease and dirt . . . Grit blasting, rough threading, threading and knurling, grooving, and electric bonding are all suitable roughening methods . . . On glass it is sufficient to heat the clean surface, roughening is not required . . . Only a light blasting is required for plastics and similar materials . . .

On flat surfaces, inside diameters and irregular surfaces, shrinkage may cause trouble; avoid it by applying thin coats, allowing each coat to cool, or heat work to temperature expected during spraying . . . Adjust gas-oxygen ratio to produce a neutral flame . . . Spray at maximum speed for the degree of atomization required . . . Hold spraying distances to the permissible minimum. Keep gun moving continuously . . . For round work, hold part between centers in a lathe and mount spray gun on toolpost.

Do not try to fasten parts together by spraying. It is a surface coating, not a welding process . . . Avoid putting sprayed metal in direct shear and never cut threads in it . . . Always apply spray within 4 hr of cleaning, otherwise oxides will form and prevent proper adhesion . . . Sprayed metal is not easy to machine; take light cuts and use special tool angles . . . In grinding use medium or coarse grain wheels with low bond strength . . . Avoid milling if possible as the cutters tend to chip the coating . . . Carbide cutting tools are best for all machining operations on sprayed metals . . . When protecting against corrosion, do not use metals that are cathodic to one another . . . For blast cleaning use steel grit rather than sand.

Because of their ability to hold oil, sprayed metal surfaces will usually outwear ordinary metals. Try them for crankshafts and similar parts . . . Try making rolls from iron pipe and spraying with stainless steel. The cost is about half that of solid stainless rolls . . . Rams for hydraulic presses given a ⅛-in. coat of stainless steel will be nearly as good as chrome-plated rams and will cost much less . . . If a non-porous sprayed surface is required, paint or dip in tung oil or linseed oil mixed with 5% by volume of cobalt liquid drier. This is important where corrosion resistance is concerned . . . Spray copper on carbon resistors and brushes to permit soldering leads . . . To eliminate heavy roughing, spray with molybdenum alloy 0.0015 to 0.002 in. thick and apply coating over this.



Cost Cutting Clinic

COLD HEADING

General . . Consider this process for bolts, screws, rivets and other headed products made from wire or bar and capable of being formed cold. It saves time, stock and labor costs as compared with screw-machine production . . . In bolt-making, cutting off, extruding, heading, trimming, pointing and rolling all are possible, and may be done at once, producing a finished piece every stroke . . . Upsetting need not be at the head; it can be at the center, or anywhere along the piece . . . Some small machines incorporate a toggle mechanism so they make two blows for each flywheel revolution.

In general, headers work best if the head diameter is not formed to more than 2½ times stock diameter, and shank length is not over 8 to 10 times stock diameter . . . In open-die machines, stock length must be at least 4 times diameter to withstand heading pressure . . . Carbide inserts will vastly increase life of solid dies; or open dies will provide four sets of dies per block . . . Thinner, broader heads require more pressure than the same volume of metal formed to a thicker, smaller head . . . Tough material requires a heavier machine than normal . . . Stock for cold heading must be free of surface imperfections and rust . . . Normal stock is lightly wiped and oiled; stainless steel is coated with a mixture of soap and lime. Too much lubricant will prevent the head from filling the cavity . . . Tolerance on wire should be ±0.002 in., and wire should be open-hearth, bright-drawn basic steel wire.

Accessories . . Don't try to head high-sulfur stock like Bessmer wire or free-cutting screw stock . . . aluminum (2S, 3S, 175, A-17S, 24S and 53S) can be cold-headed, as can brass (yellow-63% Cu, and cartridge-70% Cu), beryllium copper, phosphor bronze, silicon bronze, nickel silver, Monel, lead, zinc, silver and gold . . . A wire straightener, or combined straightener and feeder, is a good investment when wire is fed . . . Be sure shearing is clean and smooth, whether in the machine or before . . . Dies must be very accurate and should be finished by lapping . . . Working surfaces must be hard, inner areas tough to prevent splitting. Use a special steel, available from most companies, and watch heat treatment (see *A.M.*, April 8, 1948) . . . In solid dies, the holes must be absolutely concentric with the OD. Warping, roughness or scoring causes difficulties in ejection from the dies, so check die surfaces regularly and correct any potential cause of trouble—hence scrap.

SWAGING

Machines . . Clean out machines regularly, or chips, scale and dirt accumulate and will be pounded into the work surface, creating defects. Also see that work is clean . . . Minimum practical work diameter is about 0.020 in., the maximum about 6-in. dia tubing or 4-in. solid . . . Swaging helps grain structure, increases tensile strength and elasticity, increases hardness; remember this when selecting stock . . . Plated stock can often be swaged without harming the plate . . . If work is slipping, try cutting the die lubricant 50% with kerosene.

Dies . . For cold swaging, use high-carbon dies; low-carbon ones will work-harden and may split . . . Carbon-steel dies should not be hardened over 62-64 R_c for small dies, 58-61 R_c for large, or they may split . . . If materials like tungsten or molybdenum are to be swaged, use small carbide dies or carbide inserts in large ones to increase die life . . . Most die wear occurs in taper portions, so check there for first signs of the annular rings which interfere with feeding and repair them by lapping, grinding, hard facing or a carbide insert . . . About 90% of die splitting is caused by too little "oval"; see that oval is maintained (2 to 15% of work diameter) . . . For most work, hand feeding is preferable; but automatic feeds are necessary for some large work and for steep die tapers (major reductions).

General . . If large work is harder than 15 R_c, cold swaging will be difficult. This shows up as hard feeding—which may also be caused by excessive lubricant, too small a die opening or a hollow in the die taper . . . Long dents or cuts in the work result from sharp edges in the die or excessive die opening . . . Short dents or pits across the work result from poor blending of taper and blade (straight die section) . . . Flash or fin is caused by too much die opening or work sticking in dies that have too little oval . . . Peeling results from excessive die pressure (length on solid work should not exceed 10 times average diameter) . . . Scuffing of aluminum or stainless results from rough spots on dies or abrupt changes . . . Long seams or pipes result from defects in stock and suggest a better grade be used . . . Conditions that cause rough work on solids cause tubing to split . . . Tubing wrinkles result from use of a tube that is too thin for its diameter; wall thickness should be at least 1/35 OD.

PRESSWORK

Presses . . Blank coil stock and sheets in one large press; feeding coils right to left and sheets front to back . . . Use larger coils for economy and to prevent feeding troubles from crushing the coils . . . Space presses far enough apart to permit installation of mechanical handling devices and secondary-operation presses without tearing up press lines . . . To avoid extra handling of stampings, leave enough room at end of press lines for assembly purposes.

Consider "standard" press specifications (Joint Automotive Industry Committee) when buying presses . . . These presses have standardized tooling areas, which save downtime and butchering of dies to make them fit . . . To avoid costly accidents, use standard die-handling hooks . . . Use smaller, standardized die cushions because if one fails the pressure plate will still be operated by the remaining ones, while the defective is repaired.

Inventory Repair Parts . . Develop an identification system, using your own and the manufacturer's code numbers, and include drawings or identification sketches of the parts . . . This practice will save much time in hunting for repair parts and will tend to limit the inventory to items actually needed.

Study the best method of mounting presses for your needs . . . Plants on contract work mount one large press in plenty of space, so smaller presses can be grouped near it on the floor for secondary operation . . . Other firms may mount presses on continuous rails, with basement below, to permit easy re-location of machines plus servicing from below.

Watch air leaks; they often pass unnoticed in noisy press shops but are costly . . . Listen for the hiss of escaping air during idle periods or put instruments on the line to gage the pressure drop in a selected time interval.

Mechanical Handling . . Reduced handling of stamping in process is a major source of cost-cutting . . . Consider the use of suction cups and air blast to lift stampings and clear them from the dies . . . Or cookies can be carried out of the bolster by a belt conveyor and taken to a stacker or the next operation . . . Deep-drawn articles can be pulled out of dies by a mechanical hand and dropped onto a roll-over fixture for transportation in inverted position to the trimming press . . . Slat conveyors between presses avoid handling operations, save operators and help to keep press lines running at rated capacity . . . Flip-off fingers or paddles, operated from the crankshaft or ram, save an operator at the rear of the press . . . Automatic oilers for blanks reduce labor.

Carbide Dies . . Dies with cutting or forming members made of cemented carbide have greatly extended life between grinds, if the press is in good condition and the tools are properly set . . . When designing carbide dies, use sectional construction, and choose contours that are easily set up for grinding . . . To avoid cracks, avoid or minimize the use of brazing to hold carbide segments.

Safety . . Increase production by applying suitable inclosure guards to punch presses, or a mechanical guard if the former type cannot be applied . . . Follow a regular inspection procedure and use a check chart to be sure the condition of all important features are adequately checked . . . Inspect press frames at intervals for cracks and make indicated repairs before a breakdown occurs.

To Increase Output . . Secure consistently clean-cut blanks by making sure that proper clearance is provided between punch and die. . . . On close work, rebuild presses and put in a heavier bolster to minimize deflection, and thereby possibly double the number of pieces per grind . . . To avoid excessive die wear, see that the crankshaft bearings are kept in good condition . . . Frame and slide ways should be inspected and re-scraped, if necessary, before the bed is remachined, when rebuilding a press.

Do not choose the lightest press for the job, because the extra cost of a heavier machine will be more than offset by savings in die maintenance and lost production time. . . . Filler plates in cored pockets in ram give additional support to the upper die shoe against deflection. . . . Check the bed for low spots and hence inadequate support for the bolster plate . . . Keep on hand extra bolsters for every size of press used, and have these bolsters with stepped sizes of clearance or scrap holes, so that the most rigid possible bolster can be used to minimize die and press wear . . . Check parallelism of bed and ram of straight-side presses to maintain correct die clearance and reduce die wear.

Material Conservation . . As two-thirds the cost of a punching is for material, design engineers and tool engineers should collaborate in part simplification for manufacture, and then the tool engineer should choose the most economical material layout . . . Consider the possibility of resistance welding for fabrication of assemblies, to save both material and operations.

Die Selection . . Progressive dies are preferred to compound dies for use in high-speed automatic presses . . . Although parts produced in progressive dies are not truly flat (requiring an extra operation in some instances) they can be flattened very cheaply in specially built roller levelers . . . Use high quality die steel, properly hardened, for bushings and inserts, so these parts give as long life as cutting members, and minimize die grinding by so doing.

General . . A portable steam generator saves time and fire hazard in keeping presses clean at low cost and can also be used to dry cup shaped stampings that retain water after washing . . . Weak or flexible stampings can be made rigid by beads or ribs . . . Outside flanges or flanges around openings should have a height at least twice the metal thickness . . . Inside radii at bends should not be less than the metal thickness . . . To save operations and dies, make the radius at bottom of drawn stampings at least four times the metal thickness.

Die Design . . Apply shear to blanking and cut-off dies to reduce pressure . . . Be sure you apply shear to the proper tool member to avoid distortion of the product . . . A two-station progressive die costs little more than a single station die, saves building another tool, runs at faster speeds than a compound die. . . . Greatest economy in trimming is secured by combining it with another operation, such as blanking, piercing or forming.

When a die has a number of slender punches, and frail inserts, it is advisable to incorporate a positive stop, even though expensive, to avoid tool breakage . . . If all parts must be identical and flat, the use of a compound die is indicated.

Curved chutes of four guide rods will remove cookies from a blanking press and discharge at proper height above floor . . . Make provision to handle the new larger coils now offered by steel companies . . . Provide slitting equipment so that the most economical strip width can be used in the dies . . . Small air-operated presses are faster and easier for operators than toggle or kick presses, when performing riveting, staking and locking tasks.

. . . Air equipment also avoids complication in dial feeds for assembly.

SPINNING

General . . Where quantities are small, try spinning circular parts. Spinning chucks are cheaper than dies and can be made in a few hours . . . Kirksite chucks are cheaper than steel, easier to make, and will stand up well for moderate quantities . . . Try carbide spinning tools for production work, and power-operated tools for deep draws or heavy material . . . Tube end closing or reducing is a natural for spinning, but is best done hot if walls are heavy. A torch can be fixed to the lathe bed to provide the heat . . . Magnesium can be spun satisfactorily if kept hot during the operation . . . Every material has an optimum spinning speed. Keep accurate records of thickness and diameter and speed used on every job, and use these to establish speeds for new jobs . . . Try a combination of spinning and welding to save time on experimental jobs . . . Don't throw away old chucks; they can often be re-machined for other jobs . . . Hickory ax-handles make excellent tools for the first preliminary spinning operation.

ASSEMBLY

Pressure Fits . . Shrink fits can be made without injurious heating or discoloration by shrinking male parts in liquid nitrogen instead of heating female parts . . . When making press fits it is advisable to employ a press which may be accurately set at a definite loading. Sensitivity of pressure regulating mechanism reduces scrap loss from breakage, over-stressing or fatigue failure of out-of-tolerance parts.

Welding and Soldering . . Check the possibility of using resistance welding instead of arc or gas welding. Higher speeds for seams and joints, plus use of semi-skilled labor, may reduce costs . . . Consider redesigning stamped parts, forgings, and riveted or bolted assemblies to use rapid projection, spot or seam welding. Higher production rate, lighter weight, reduced material cost, plus greater strength and improved appearance will result . . . Aluminum welding fixtures are easier to handle, save time and labor . . . Avoid using multi-piece or screw clamps—cam type are easier and faster . . . Controlled - atmosphere furnace brazing permits making many joints at a time, gives a better appearance, and is faster than hand brazing . . . Avoid manual soldering; instead, use induction heat and solder preforms . . . Consider the conditions the joint must withstand, temperature, vibration, or other stresses, and be governed accordingly. Don't use silver solder if soft solder is good enough.

Threaded Assemblies . . Through-bolts are easier to assemble and replace than studs which may loosen up and cause trouble . . . Use standard lengths and styles of bolts and screws as they are cheaper and more readily available . . . Patent fasteners are cheaper and easier to assemble than nuts and are particularly use-

ful on light work . . . Threaded inserts molded in place save time and trouble in plastic and die-casting assemblies.

Power screwdrivers and wrenches are inexpensive and can easily cut assembly time in half . . . Impact wrenches will tighten nuts harder than is possible by hand . . . Where tightness of nuts is critical, best results can be had with torque wrenches . . . Preplaced lockwashers can substantially reduce assembly time when using small screws . . . Self-locking nuts are completely reliable and save the trouble of fitting jam nuts . . . Most sheetmetal parts can be attached with special screws that do not require nuts . . . Drive screws or self-tapping screws are excellent for light work, and avoid tapping.

General . . Assembly fixtures permit operator to use both hands, but must be designed to allow maximum accessibility . . . Bins to hold small parts should be arranged within easy reach of operator and will save much sorting and fumbling . . . Don't permit operators to stop work to pick up small nuts or other inexpensive parts that drop on the floor. The time for doing this usually costs more than the part is worth. Such parts can be swept up and scrapped or sorted by cheaper labor . . . Where possible, eliminate use of separate fasteners by integral lugs cast or formed on one part and clinched or spun over after inserting into hole in mating part . . . Investigate the possibility of using adhesives for joining metal to metal or metal to non-metal, but be sure to select the right material for the job in hand. Not all adhesives are suitable for all types of work . . . Check designs carefully to see whether some operations can be eliminated by making certain parts integral with others . . . Line assembly is not always best. Sometimes spot assembly, or a combination of spot and line may be more economical . . . Merry-go-round conveyors need not be confined to big jobs. They may be profitable for as few as four assemblers . . . Hard, smooth-surfaced composition is better than wood for bench tops as it will not hold chips that may scratch finished parts . . . Provide lintless dusters for wiping delicate parts, and beware of felt or other soft pads that may hold chips . . . If possible, apply final finishing coat after assembly. This will permit rougher handling and save much retouching or refinishing.

When handling heavy parts, see that operators understand where slings may be attached . . . Make provision for suitable eyebolts for hoisting purposes . . . See that jacks, cranes and other hoisting equipment are available, and do not permit the use of home-made jury rigs . . . See that all lifting gear is in good shape and is tested regularly. This costs less than an accident . . . On your own products, design with ease of handling in mind.

FINISHING

Painting . . Spray painting is faster than brushing and usually produc-

es a more acceptable appearance, but the equipment should be suited to the job. Don't try to paint big jobs with half-pint spray cans . . . For continuous work, circulating paint systems save money by avoiding periodic shutdowns for refilling containers . . . Consider the possibility of using fully automatic spray systems . . . Electrostatic spraying gives smooth, even coats and virtually eliminates overspray. Electrostatic detearing prevents runs and improves appearance . . . Make sure that air supply is free from oil and water, and that regulators are properly adjusted to maintain constant pressure.

Use the best quality paint. Coat should be measured on square feet covered per gallon, rather than on price per gallon . . . Incorrect viscosity accounts for serious paint losses. Better have one man responsible for all mixing, and give him the proper equipment, including viscosity cups and stirrers . . . Remember that there is no universal thinner. Use the one recommended by the paint manufacturer . . . Primer coats may not be necessary for every job, and a number of one-coat finishes are now available . . . If primer coats are used, try using a color slightly different from the finish coat. This will make it easier for the operator to see that he is covering all surfaces and may save considerable retouching.

To cut down on overspray, see that operators trigger their guns at the end of each stroke . . . Spray booth cleaning time can be shortened by coating interior surfaces with peelable plastic coat . . . Exhaust systems pull out paint fumes but may also pull in dust-laden air. For high quality work it is better to have booths fully enclosed and maintain slight positive pressure . . . Install turntables, manual or power, for jobs that are to be painted all around, or use swivel hooks on the conveyor.

For brush painting use only the best quality pure bristle or synthetic fiber brushes in widths suited to the size of the job . . . Clean brushes properly after every use, and store in protective wrappers. Keep water away from natural bristle . . . Paint brushes are costly items, but more brushes are ruined by neglect the abuse than are actually worn out. Brush manufacturers gladly supply booklets giving complete information on proper care and use of brushes; it will pay you to read one and pass it along to those concerned . . . Buy brushing paint in small containers, preferably not more than one day's supply to a can, to avoid loss by evaporation.

Scrupulous cleanliness is essential to successful painting, and no care is too great to exercise in this regard. Once properly cleaned, surfaces must not be touched by hand. If they must be touched, use clean, dry cotton gloves . . . Rust is an insidious thing and may have started its work long before it can be seen. For maximum protection use rust-inhibiting chemical coatings; they cost money but pay off in increased service life and are an important selling point . . . Galvanic corrosion may start when two dissimilar metals are in close contact. It can usually be prevented by painting the contact areas . . . For large, flat surfaces, investigate flow or roller coating.

Electroplating . . Thorough cleaning is the key to successful plating, and most failures can be traced to the presence of foreign matter on the surface. To save on polishing costs, investigate the bright plating compounds now available. They yield a high luster direct from the bath . . . Ball type anodes are usually more economical than bar types as they can be used up completely . . . Continuous filtration insures clean plating solutions and produces better quality work. If not practicable, then filter baths at frequent intervals . . . Agitation of the work insures even plating and tends to eliminate gas bubbles . . . Proper attention to the way the work is suspended in the bath will prevent shading of one part by another and will avoid the possibility of entrapped gas causing unplated areas . . . Automatic plating machines have many advantages over still tanks for quantity production and usually occupy substantially less plant floor space. **General . .** Paint sludge from water-back spray booths can be salvaged. It is not generally advisable to reuse it for quality work, but it can be turned into a useful house paint . . . Dirty solvents used for cleaning can be recovered and distilled for reuse. In shipping these, do not fill the drums closer than 3 to 5 in. from the top, but do not ship half-empty drums . . . Select a polishing compound specially prepared for the type of material being handled, and consider the possibility of using an automatic polishing machine. This will reduce the time required for manual operation . . . Keep polishing machines and equipment well away from the plating and painting rooms.

TREATING

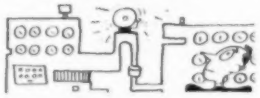
Flame harden or induction harden gear teeth only, or sprockets and change gears . . . Induction harden progressively, long lead screws for less distortion. This also permits the use of less-expensive steel . . . For production surface hardening, use gas carburizing instead of pack carburizing . . . Try direct quenching from gas carburizing units for fast, uniform case hardening. Use of ammonia gas through part of the cycle assures a file hard surface . . . Use live steam to clean cyanide deposits from small holes after removing from rinse. Provide asbestos gloves lined with rubber gloves for safe handling of steam hose and part . . . To flame harden ends of parts such as small bushings, set up the part in a pan of water, so that water just covers the surface to be hardened. Application of acetylene flame blows water away and heats the work. Removing flame allows water to return and quench the heated surface . . . Try stainless steel clad copper for salt pots. This will provide even heating and cooling, thus eliminating solidifying at the top; danger of rupture from confined expansion . . . Hard-chrome plate shaft bearing (about 0.002 in.) on nitride circulating fan where sand seal is

used, to minimize wear on bearings, but continue to clean these regularly . . . For tool and die shop furnaces, install timer switch to turn on power a few hours before starting time so that it is ready when work begins . . . Salt-bath baskets last longer if parts are quenched; not baskets.

Check automatic temperature controls daily for balance and operation. Check temperature reading and thermocouple at least once a week . . . Clean furnace thoroughly at regular intervals to prevent dirt and scale from shorting and burning elements . . . Normalize forgings with a furnace, rather than weather-conditioning outdoors. Results are just as good, inventories need not be as large, storage space is conserved, and less allowance is necessary for tolerance variations . . . Provide an assortment of tongs handy to the furnace; some should have blank jaws for shaping to special contours.

Try automatic sand blast equipment rather than manual blasting . . . Special abrasion resistant rubber is available which will withstand the action of shot and sand many times longer than conventional natural and synthetic rubber, or steel . . . Use of steel shot for cleaning may save you money as it can be reused many times. However, be certain that broken shot is removed before reuse. This is simple with sorter now available . . . Die-cast parts which were originally sand blasted after casting are now cast with the sand blast finish. Someone thought of sand-blasting the dies . . . Shot peening will sometimes increase tensile strength over normal, without increasing weight of part . . .

Cold, or "deep-freeze," treatment of some metals will provide metallurgical advantages such as increased hardness and better grain structure. Investigate this for possible use but be cautious as its value is limited to a small group of metals . . . Select materials for heat-treatment carefully. Be sure that all necessary steps are followed in the right order. Check that furnace is being loaded for best heat distribution; that parts aren't chilling as they are drawn from furnace . . . There is no "second best" in heat treat. It must be done right the first time.



INSPECTION

Quality Control . . Reduce inspection time and maintain uniform control by replacing 100% inspections with spot checks and sampling inspections . . . "Final inspection" as such, is anticlimactic, producing nothing. Quality control, on the other hand, is productive, as it is an operation toward improvement. By inspecting an entire lot when completed you learn only that you have lost money on the errors; sampling inspections bring out the errors as they occur and provide time for correction . . . Avoid overdoing quality control plans. Keep it as simple as possible. Select one system and stick to it. Some people claim that Q.C. is too involved to be efficient. This is not true if the plans are based on a sound knowledge of the principles. Haphazard use of the technique will make you sorry you started . . . Never tell the man in the shop how to do the job—show him the error or inconsistency and let him make his own corrections.

Install a unit time plan on inspection which will indicate to the inspector the amount of time that should be devoted to the job . . . Provide operation sheets for inspection which save time by showing how and where to measure production parts . . . Vendor inspection working directly with receiving will minimize unexpected errors in units containing purchase parts which may be out of tolerance.

Tools . . Use modern precision inspection tools. Keep constantly informed on the latest time-saving and accuracy maintaining tools . . . Try a dial indicator plug gage with a set of extensions to eliminate the need for a number of solid plug gages. This is less expensive and shows not only the size, but the amount of variation . . . Electronic measuring equipment such as electronic sorters and comparators will save time and provide greater accuracy; less guesswork . . . Keep all contacts between work and the indicator as direct, simple, and free of breaks or lost motion as possible . . . Try multiple gage inspection fixtures where a number of single gaging operations are performed and the job will not stand fully automatic gaging equipment . . . Reversible plug and thread gages provide twice the wear-life of ordinary gages and, by interchangeability, require less storage space; are more versatile . . . Dial indicators can be a great advantage in every type of inspection operation. Providing a visual indication of size, they speed measurement and improve accuracy. Arranged in multiple units they can tell the entire story in one motion.

Salvage . . What are *you* doing about salvage? Here is an added operation which can produce real profit. Start by getting a complete report covering every by-product, every bit of waste, every scrap part, that results from your plant operation. Set up a salvage committee that includes maintenance, production, inspection, and purchasing representatives. Discuss the report with them. Find a use for every possible item that is now a loss. Coolants can be reclaimed; chips and scraps can be sold; paper and cardboard from drafting room or receiving department can be baled and sold; almost everything has some value—don't throw it away until you check. Particularly stress a parts salvage inspection department . . . Are parts scrap because they don't match the print or because they won't work? Perhaps the tolerances that cause parts to be rejected are not important . . . Can you use the rejected part somewhere else? . . . Will a slight change in the mating part provide a satisfactory sub-assembly? . . . How much so called "scrap" really is? Study might provide a very pleasant surprise . . . See that the supervisor of salvage inspection is capable, alert, and imaginative —you will have a staunch ally . . . Provide a bonus based on the total value saved—after rework.

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THE METAL SHOW

CLEVELAND • OCTOBER 17-21

SPONSORING SOCIETIES: *American Society for Metals* • *American Welding Society* • *American Institute of Mining and Metallurgical Engineers* • *Society for Non-Destructive Testing*

"ECONOMY in Production" is the theme of the 31st National Metal Congress and Exposition to be held in Cleveland October 17-21. Approximately 350 nationally known firms engaged in either the production, treatment or fabrication of metals, or in rendering services to all of these, will exhibit their products, equipment or services in Cleveland's huge Public Auditorium. Over 200,000 sq ft of floor space has been assigned to the companies who will participate in the five-day show. Features scheduled for the accompanying Congress include round-table discussions on the Show's theme, "Economy in Production." An "Economy Theater" will enable exhibitors having motion pictures depicting production economies to show their films. Seminar sessions, educational lecture courses, technical programs, and other special meetings by the sponsoring societies will be held each day.

Metal Show Exhibitors

A — BOOTH

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Acme Tool Co. 1758
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Air Force 2715
Air Reduction Sales Co. 2126
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Ajax Electrothermic Corp. 1901
Ajax Engineering Corp. 1901
Allen Mfg. Co. 1615
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Alloy Engrg. & Casting Co. 210
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Aluminum Co. of America 2627
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American Forge Div. 325
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Selected Technical Papers

MONDAY, OCT. 17

American Society for Metals

Alloy Steels

Tensile properties, heat treated low alloy steel at sub-zero temperatures.
Relationship of inclusion content and tranverse ductility of a chromium-nickel-molybdenum gun steel.
The effect of vanadium and carbon on the constitution of high speed steel.
Unnotched impact strength of high speed steels.
Effect of boron and kind of boron addition upon the properties of steel.
Characteristics and properties of cast low-chromium molybdenum steels.
Iron manganese and iron-manganese nickel alloys.
Metallurgical factors affecting the magnetic and mechanical properties of iron-cobalt alloys.

American Welding Society

Pressure Vessels

Trends in fabrication by welding.
Inert-gas-shielded arc-welding aluminum pressure vessels.
Notch sensitivity of mild steel plates.

Hard Facing and Flame Hardening

Automatic electric hard facing.
Hot hardness of hard-facing alloys.
Flame hardening of large diameter rounds.

Nonferrous Metals

Arc welding of molybdenum.
The welding of high-nickel alloys to other metals.
Seam welding monel metal to steel.

Research

Brittle failure and size effect in a mild steel.
Weld-peening investigations.

American Institute of Mining and Metallurgical Engineers

Precipitation and Aging

The effect of quenching on the age hardening of two aluminum alloys.
Size effects in quenching high purity precipitation-hardenable alloys.

Fracture and Strain Phenomena

The effect of ferrite grain size on notch toughness.
Investigation of temper brittleness in low alloy steels.
The effects of molybdenum and commercial ranges of phosphorous on the toughness of 0140 Pct. carbon chromium steels.

TUESDAY, OCT. 18

American Society for Metals

Quenching

A quench cracking susceptibility test for hollow cylinder.
An engineering analysis of the problem of quench cracking in steel.
Pre-bore quench for hollow cylinders.
Statistical methods for evaluating the quality of wrought steel products.

High Temperature Metallurgy

Influence of strain rate and temperature on creep of cold-drawn ingot iron.
Stability of AISI alloy steels at elevated temperatures.
On the extrapolation of short time stress rupture data.
The tungsten-iridium thermocouple for very high temperatures.

American Welding Society

Resistance Welding

Material consumption rates and flashing characteristics.
Factors affecting the quality of production flash welding.
The homopolar generator stored-energy system for resistance welding.
Circuit analysis of frequency changer welders.

Machinery Welding

Weldment design, engineering practice.
Lowering cost of welded construction.
Aluminum bronze electrodes.

Symposium on Ship Structure Research

Bend and tensile specimens as indices of performance and weldability.

Resistance Welding

Spotweld consistency studies.
Spot welding heavy gage structural steel.
Slope control and its effect on spot and projection welding.

Miscellaneous

Welding of zinc-base diecastings.
Silver alloy brazing stainless steel.

American Institute of Mining and Metallurgical Engineers

Transformations

Kinetics of austenite decomposition—ferrite nucleated products.
Free energy changes accompanying the martensite transformation in steels.
Hardenability effect of molybdenum.

Fracture and Strain Phenomena

Simultaneous aging and deformation in metals.

Structure and Identity of Materials

Isolation of carbides from high speed steels.

WEDNESDAY, OCT. 19

American Society for Metals

Transformations In Steels and Temper Brittleness

Measurement of retained austenite in carbon steels.
Effect of alloying elements on the transformation characteristics of induction hardened steels.
Influence of composition on temper brittleness in alloy steels.
Isothermal temper embrittlement.

American Welding Society

Apparatus

Measurement of flux densities in steels for magnetic particle inspection.
Economical arc welding.

Resistance Welding

Fatigue tests of spot-welded mild steel and stainless steel sheets.
Spot welding galvanized steel.
Design and application of portable resistance welding tools.

Aluminum

The economy of shielded arc welding of aluminum.
Sheet strength consistency of spot welds in Alclad 24S-T3.
Heliarc welding of aluminum alloys.

American Institute of Mining and Metallurgical Engineers

Powder Metallurgy

Determination of boundary stresses during the compression of cylindrical powder comp cts.
A dilatometric study of the sintering of metal powder compacts.

Society for Non-Destructive Testing

Non-Destructive Testing Techniques and Equipment

Radium, tantalium and cobalt as sources of radiation for industrial radiography.
Sonic inspection by the immersion technique.
High voltage X-ray equipment and technique.
Non-destructive hardness testing.

Industrial Applications of Non-Destructive Testing

Current applications of magnetic analysis inspection.
Testing of jet engine parts.
Simulated service testing for establishing non-destructive testing standards.

THURSDAY, OCT. 20

American Society for Metals

Mechanical Metallurgy

New equipment for damping capacity, elasticity, and fatigue testing and the correlation of these properties for mild steel.
New criteria for predicting the press performance of deep drawing sheets.

American Welding Society

Arcs and Electrodes

Application of mild steel welding electrodes.
Energy distribution in electric welding.

Weldability

The high-frequency notch bend test.
Studies concerning the strain-aging of arc welds in mild steel.
Synthetically heat treated specimens for weldability.

Society for Non-Destructive Testing

Non-Destructive Testing in Industrial Management

Peacetime preparation for quality control during industrial mobilization.
Magnetic inspection methods.

FRIDAY, OCT. 21

American Society for Metals

Nonferrous

Effects of quenching rate and quench-aging on the tensile properties of aluminum alloy 61S.

American Welding Society

Inert Gas Welding

Heliarc welding in the automotive industry.
Inert gas shielded metal arc welding process.
Automatic heliweld applications.
Applications for helium in inert arc welding.

Stainless Steel

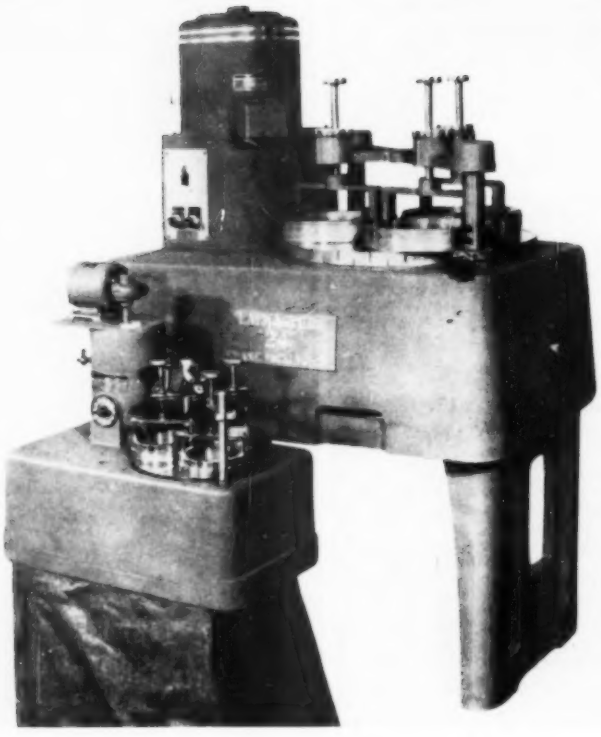
Corrosion resistance of molybdenum bearing stainless steel weld metals.
Problems associated with the welding of stainless clad steel.
Stainless steel fabrication by inert-gas-shielded arc welding.

Gas Cutting

New developments in oxyacetylene cutting machines.
Flame cutting.

SHOW IN PRINT

Products shown in this section have not been described previously in our pages. They will be exhibited at the National Metals Congress and Exposition, Convention Hall, Cleveland, October 17 to 21



Automatic Lapping Machine Is Self Conditioning

Applicable to production runs or individual jobs, the Lapmaster is designed to handle work of various sizes and shapes in one operation. Combined workholders and conditioning rings continuously maintain the desired lapping plate surface to within 0.000016 in. By regulating these rings the operator can form the lapping surface for flat, concave, or convex work.

The entire lapping cycle is automatic, controlled by a setting clock, which automatically turns the cycle off at a predetermined time. The solenoid compound valve automatically controls flow from the continuously agitated compound tank.

The Model 12 Lapmaster is equipped with a 12-in. lapping plate and three conditioning rings, each with an internal capacity of 4½ in. The Model 24 has a 24-in. lapping plate and three conditioning rings of 9¾-in. or four of 8¼-in. dia. Six models are available with lapping plates of 12, 24, 36, 48, 60 or 72 in.

Crane Packing Co., 1800 Cuyler Ave., Chicago 13, Ill.

Water Jets Cool Work on Dual-Belt Surfacer

The AB dual-belt wet surfacer is for the flat preparation of metal or graphic specimens. It is powered by a ½-hp, 2-speed motor, controlled by a 2-speed rotary switch and reset button for overload. Two belts of different grits are driven directly and travel at selective speeds of 1600 and 3200 fpm. for either slow or fast grinding. Grinding area available is 4 x 6½ in.

Water jets provide coolant directly to the top surface to assure clean cut and cool grinding. If water and drain

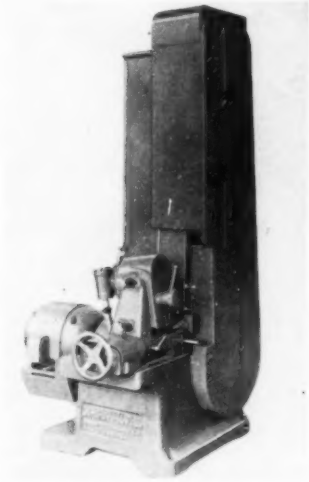
facilities are not handy, the independent cooling system No. 1256 is available to permit grinding with soluble oil.

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Ill.

Lead Alloy Protects Chromium Plating Equipment

Nalco Metal is specifically designed to give chromium platers longer lived tank linings, heating and cooling coils, and anodes. A lead alloy, it is furnished in sheet and pipe form.

National Lead Co., 111 Broadway, New York 6, N. Y.

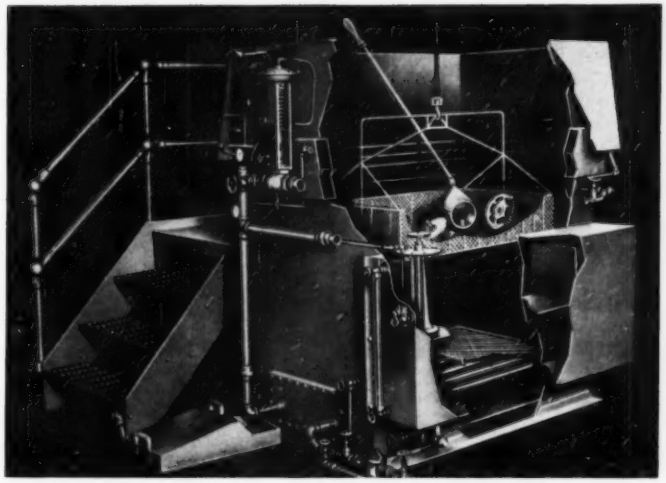


Platen Pedal Eliminated In Centerless Polishing Machine

The redesigned Type A centerless polishing machine is equipped with a new centerless belt feed mechanism incorporating roller bearings in gear reduction units and removable side plates. The platen operating pedal has been replaced by feed box.

Th old style movable platen has given way to two stationary cylindrical platen bars which are adjustable for different types of polishing and finishing operations. Fine tooth steel ratchets and pawls have replaced cast iron in the machine's belt tightener on both idler pulley assemblies. Hinge doors make the belt tracking screws readily accessible without opening the main door of the inclosure.

Production Machine Co., Greenfield, Mass.



Degreaser Cleans Tools With Non-Flammable Solvents

The Model VS-800 Detrex Degreaser removes oil, grease, and dirt from metal parts by hot solvent vapors and pressure spraying so that work comes from the machine clean and dry. It is a single compartment unit and can be fitted with whatever kind of heating means are available.

A large water jacket condenser encircles the top of the degreaser. In operation the boiling compartment of the machine is filled with nonflammable safety solvent—either Perm-A-Clor or Triad. On heating the degreaser is filled with solvent vapors up to the center of the condenser. These vapors condense on the cool work placed in the machine producing the first phase of the cleaning action as condensed vapors flow over the work and dissolve oil and grease. Clean cool solvent, collected in the storage tank from the side walls of the condenser is pressure-sprayed on the work to remove caked-on or insoluble soil.

Optional accessories include work basket, fixtures, temperature controls, work platforms and exhaust systems.

Detrex Corp., P.O.Box 501, Detroit 23, Mich.

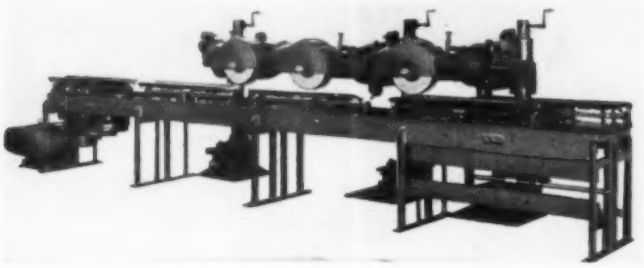
Magnetic Comparator Separates Materials at Production Speed

Magnetic analysis comparators provide fast non-destructive inspection of ferrous and non-ferrous materials, indicating variations in composition, condition, structure and process.

These units are manufactured under two classifications; production and special. The former are for ferro-magnetic materials only. Dual frequency special units are for inspection of both ferrous and non-ferrous materials. They are now available with two sets of coils. One, with an inside diameter of one inch, can test varying sizes of materials placed either inside or outside the openings of the two coils. The second set, designed as a pair of probes, tests metal forms and shapes not readily tested by the other pair.

Magnetic analysis comparators can be run by unskilled operators and separate materials at production speeds.

Magnetic Analysis Corp., 42-44 - 12th St., Long Island City, N. Y.

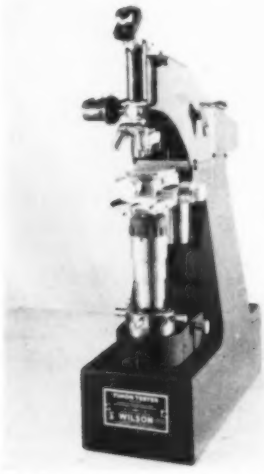


Buffing, Polishing Machine Employs 7 Platens

The Acme Horizontal Return Type Straight Line Automatic Polishing and Buffing machine consists of a 10-ft drive section and a 10-ft chain take-up section bolted together to make a 20-ft straight line unit. Seven platens employing universal type camming fixtures make this machine adaptable to suit various parts. Three Acme type G-3 adjustable floating head buffing lathes are shown with this unit. The drive section has ample power to add 10-ft sections to a maximum of 70 or 80 ft.

Work may be loaded and unloaded on either side or either end and buffing lathes may be set on one side or both sides to suit the customer's particular requirements. Buffing lathes can be added as needed.

Acme Mfg. Co., 1645 Howard St., Detroit 16, Mich.



Tukon Hardness Tester Made In Bench, Floor Models

Capable of applying loads from 1 to 1000 grams, the Tukon Model MO hardness tester is mechanically operated and is adaptable to either Knoop or 136° diamond pyramid in denters.

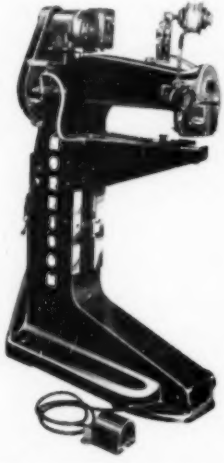
Load is applied under dash pot control, the speed of which may be varied from less than 0.040 in. per min, to as fast as testing permits without impact influencing results. The load is automatically removed. Focusing the impression under the microscope is done by elevating unit and special focusing adjustment.

Wilson Mechanical Instrument Co. Inc., Associate Company of the American Chain and Cable Co. Inc., Bridgeport 2, Conn.

Simple Operation Sets 400 Industrial Diamonds Per Day

Capable of setting both single-stone cluster and multi-stone type diamond tools under proper conditions, this equipment can set 400 industrial diamond tools per day. The entire operation is set up on a small bench and involves only three pieces of equipment. Toolbits are in six different sizes and are of round steel bar stock about 2 in. in length. One end is drilled to a depth of ¾ in. in a bench lathe to accommodate the metal into which the diamond is to be set. The drilled end is then filled with powdered A-metal contained in the small hopper. This material is a mixture of cadmium, copper, chromium, and nickel powders, together with a special fluxing agent, particle size averaging 1-3 microns or in the neighborhood of 300 mesh. The diamond is then centered in the filled bit and tapped into the compacted metal powder with hand-press and punch. Heated in ring gas burner, powdered metal fuses while silver solder is added to strengthen the setting of the diamond.

National Diamond Laboratory, 108 Fulton St., New York 7, N. Y.



Stitcher Fastens Metal to Metals or Non-Metals

The Acme Morrison metal stitchers fasten metal to metal or to non-metallic materials such as rubber, wood, asbestos, or cloth. The stitch is formed from a continuous length coil of steel wire.

This method is said to often replace rivets, screws, or spot welding. No prepunching, drilling, or matching of holes is required. The wire punches its own hole as the stitch is driven. Pictured is Model N2C-25 heavy-duty metal stitcher.

Acme Steel Co., 2840 Archer Ave., Chicago 8, Ill.

Oakite Composition Seals Acid Pickling Solutions

Oakite Composition No. 38, Fume-Seal, produces a dense foam blanket which seals acid pickling solutions in evolved gases. It is said to be extremely stable in highly acetic solutions and forms dense foam blankets on nitric-hydrofluoric, hydrochloric,

and sulfuric acid solutions, preventing escape of acid fumes.

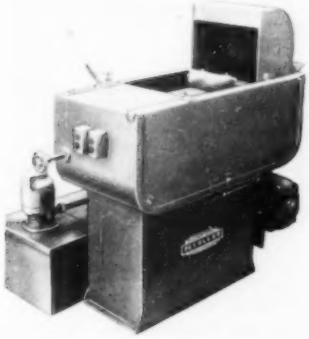
The composition is reported to minimize the fuming of dips such as nitric-hydrofluoric acid on cast aluminum, nitric-sulfuric acid on brass and copper alloys at room temperature, and nitric-sulfuric-zinc oxide at 180° on copper alloys and brass.

Oakite Products Inc., 22 Thames St., New York 6, N. Y.

Shape-Cutting Machine Is Portable Oxyacetylene Unit

Including a manual tracing device, torch, tip, track, and hose, the portable Airco No. 3 Monograph weighs only 110 lb. It has a cutting area 32 in. wide and 4 ft 8 in. long. By addition of track sections length of cutting area can be extended as desired. In addition to regular shapes the machine will cut straight lines, circles and bevel jobs. The No. 3 Monograph sells for $695.

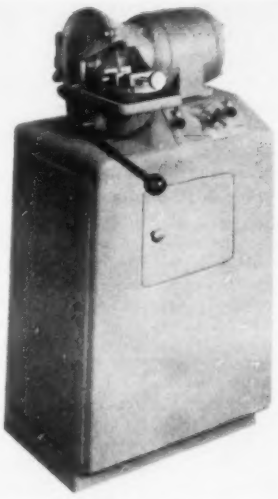
Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.



Peerless Surfacing Machine Operates Wet or Dry

Developed to answer an increasing demand for a smaller size, less expensive machine for surfacing and finishing small castings, forgings, diecastings, and metal products, this unit weighs approximately 800 lb. A ribbed surface platen replacing the conventional smooth one is said to permit faster cutting speeds, more efficient operating conditions, and smoother surfacing. Waterproof abrasive belts, 9 in. wide x 85 in. long operate surface speed at approximately 4400 fpm. The unit covers a 40 x 63 in. floor space.

Production Machine Co., Greenfield, Mass.



Lab Size Cutting Unit Handles Samples Up to 1-in. Dia.

Cut-off machine No. 1010 AB is a 1-hp laboratory-size cutting instrument with ample power for fast cutting of samples up to 1-in. dia. The cutting wheel is mounted directly on the ball-bearing motor shaft. It is free from size play or vibration, and is cooled by a stream of coolant directed on both sides of the wheel under the guard. A vise holds the sample to the carriage.

Buehler Ltd., 165 W. Wacker Drive, Chicago 1, Ill.

High Chrome Alloy Has High Abrasion, Oxidation Resistance

Thermalloy HC-250 is a high chrome alloy said to have exceptional resistance to abrasion, oxidation, and wear at elevated temperatures. It can be machined in the annealed state and then rehardened to 650 to 750 Brinell. Knives made of this material, operating in a brick plant pugmill, are said to have lasted 5½ times as long as knives made of alloyed white cast iron.

American Brake Shoe Co., 230 Park Ave., New York 17, N. Y.

Horizontal Comparator Provides Wide Application Range

Chief applications of the Cooke Horizontal Comparator are verification of diameter, roundness, and parallelism of plug ring and rectangular gages. Attachments are provided for determining pitch diameter, roundness, and parallelism of male and female screw thread gages. A 1000-X magnification opticator with only one moving part facilitates quick accurate readings. The opticator is also adapted for use on vertical machines.

R. Y. Ferner Co., 110 Pleasant St., Boston 48, Mass.

Eutectic Welding Offers AC-DC No Gap Electrode

The Eutec-Hand-Omatic no gap electrode is pressed against the metal and drawn along like a pencil. It is said that a perfect weld results automatically, and since there is no arc gap maintained, the ease of operation is apparent.

Risk of burning through thin sheet with this electrode is said to be negligible. For use with both ac and dc Eutec-Hand-Omatic has a tensile strength of 70,000 to 80,000 psi, and is available as follows: No. 1 in 3/32, 1/8, and 5/32 in.; No. 2 and No. 3 in 1/8 and 5/32 in.

Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.

Manhattan Moldisc Is Bonded Grinding Wheel

Among the advantages claimed by manufacturers of the Manhattan Moldisc are: (1) much longer life; (2) increased production; (3) reduced grinding costs; (4) uniform cutting action; (5) less operator fatigue, and (6) greater ease in handling.

Disks are supplied in standard 7-in. diameter, ¼-in. thickness with ⅞-in. hole. Speeds up to 6000 rpm are recommended for best efficiency.

Abrasive Wheel Dept., Raybestos Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.

Clinometer Sets Vertical Angles Within Range of 360°

Designed on robust lines intended for general use in the toolroom, this instrument gives unimpaired readings through its entire range. Light from an external source passes through the annulus and microscope to the eye and is impeded by the graduations which appear jet black against a field as bright as the user cares to make it. A table is provided giving degrees, minutes, and decimals of minutes to two places for sub-divisions of the circle to any number of equal parts from 2 to 200.

The R. Y. Ferner Co., 110 Pleasant St., Boston 48, Mass.

Air Bender Fabricates Irregular Metal Parts

Air-operated model bender for fabrication of irregular shaped metal parts will handle up to 3/16 x 1½ in. wide aluminum, cold-rolled, hot-rolled, plastic, copper, brass, or bronze. Tooling costs are eliminated in making special brackets, clips, straps, and other irregular shaped metal parts. The machine is sold with a complete assortment of tooling.

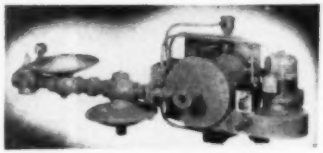
J. A. Richards Co., Kalamazoo, Mich.

Free Machine Alloy Steel Boosts Tool Life Span

Rycut is recommended by its producers for the manufacture of strong, tough parts involving considerable machining.

It is reported that in comparison with AISI 4150 Rycut hardenability is approximately the same, machine time saving ranges from 25 to 50 percent, tool life is increased up to 100 percent, and less grinding time is required after hardening. The latter is due to better surface finish secured by machining.

Joseph T. Ryerson & Son, Inc., Chicago, Ill.



Boiler Gas Burner Adaptable To Old or New Boiler Settings

Self-contained North American Series 115 boiler burner is a package unit easily installed in either old or new boiler settings. Two sizes are available at present—one for 2.5 million btu input and the other for 5 million, developing approximately 50 and 100 boiler horsepower respectively.

A blower within the burner furnishes combustion air allowing complete fuel-air ratio control. With control panel incorporating all safety devices and modulating control, the unit is entirely automatic.

Installation of the burner is simple. Piping consists of only the gas line, and the few wires are well marked for easy connection by the customer. The unit is assembled in the factory.

Operation of the Series 115 boiler burner is reported to be exceptionally quiet and clean and requires practically no servicing.

North American Mfg. Co., 5555 E. 71st St., Cleveland 5, Ohio

Optical Dividing Head Has 90° Vertical Angle Range

Accuracy of dividing of the Cooke optical dividing head is said to be 10 sec. of the arc. This is made possible by use of the high-powered microscope contained in the head.

The unit is supplied with a bed for checking operations, but can be placed on machine tool beds for light finishing cuts. The head of the instrument may be raised or lowered through a vertical angle of 90° and may be set at any intermediate angle to an accuracy of one min.

The R. Y. Ferner Co., 110 Pleasant St., Boston 48, Mass.

Rotary Furnace Operates As Continuous or Batch Unit

Requiring only one operator, this rotary furnace can be used for carburizing, carbonitriding and clean hardening. By turning a selector switch the unit can be converted from a continuous furnace to a batch type unit.

Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.

Production Inspection Unit Detects Metallurgical Defects

The MAL-3 high-production inspection unit automatically inspects automotive connecting rods, spindles, and similar parts at production speed. Placed on a conveyor, parts are magnetized both longitudinally and circularly, and Magnaglo bath is applied. Cracks, forgings laps, and similar defects are indicated, no matter what direction they may lie in on the part. The part is then automatically presented and rotated under black light before the inspector who operates in a semi-darkened booth. A fluorescent glow indicates a defect. Defective parts are rejected by pressing of a button.

The Magnaflux inspection unit is said to facilitate both cheaper and more effective high speed inspections than either the visual inspection or the old pickling method.

Magnaflux Corp., 5900 Northwest Highway, Chicago 31, Ill.

Electrode Core Wire Coated With Chrome-Moly Alloy

Chromoly arc-welding electrodes have mild steel core wires coated with chromium-molybdenum alloy which will deposit high-tensile metal in high-tensile steels. Three types of coating with varying amounts of alloying ingredients are manufactured and fall in the American Welding Society specifications for E-xx10, E-xx13, and E-xx16 classes. These are all-position type electrodes and tensile strengths varying from 80,000 to 130,000 psi can be attained in the deposited metal when they are properly stress relieved.

The Champion Rivet Co., Harvard Ave. and East 108th St., Cleveland 5, Ohio

Phase Contrast Accessories Adapted for Standard Microscopy

Bausch & Lomb Phase Contrast Accessories for metallography consist of three parts; a basic phase contrast instrument, a centering telescope, and an annular disc. This equipment is said to mark the first commercial application of a phase contrast system in which standard microscope objectives can be used. It will fit B&L Metallograph (Research ILS or MILS) and can be quickly and easily attached. There are no special phase objectives to buy.

Bausch & Lomb Optical Co., Rochester 2, N. Y.

Air Replaces Hand Control

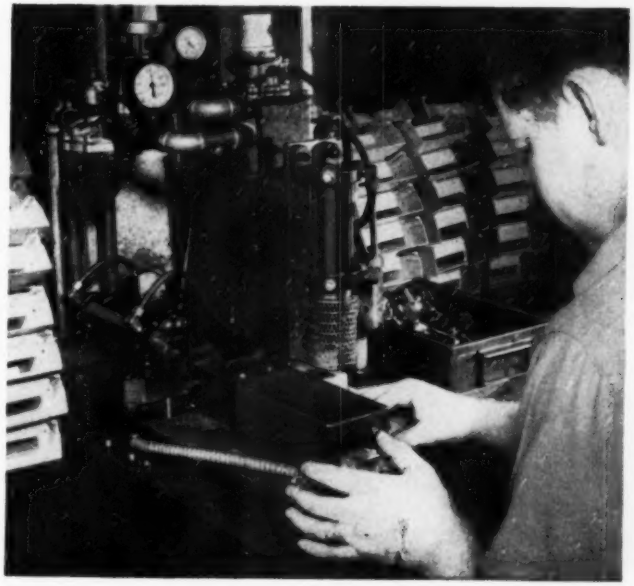
BY WILLIAM R. APBLETT, Tool Engineer
Sangamo Electric Company

CONSIDERABLE savings can be accomplished with properly applied air cylinders. Experience to date in the production departments at the Springfield, Ill., plant of Sangamo Electric Company has shown that this is true, as compared with manually operated fixtures for the same operation. As a result, all operations in the plant are reviewed from time to time to determine whether air operations of fixtures would be advantageous.

Air cylinders controlled by small solenoid valves and Micro Switches have been built into a number of assembly fixtures and bench presses. Parts production and subassembly operations on many meter components are thus simplified. Typical of these fixtures are the two shown, which were developed recently.

These fixtures are of interest because they serve a dual purpose. In each case one switch is used to set the control circuit when the workpiece is correctly positioned, and a second switch actuates the air cylinder at the operator's touch. This insures both that the workpiece is in place, and that the operator's hands are out of the danger area.

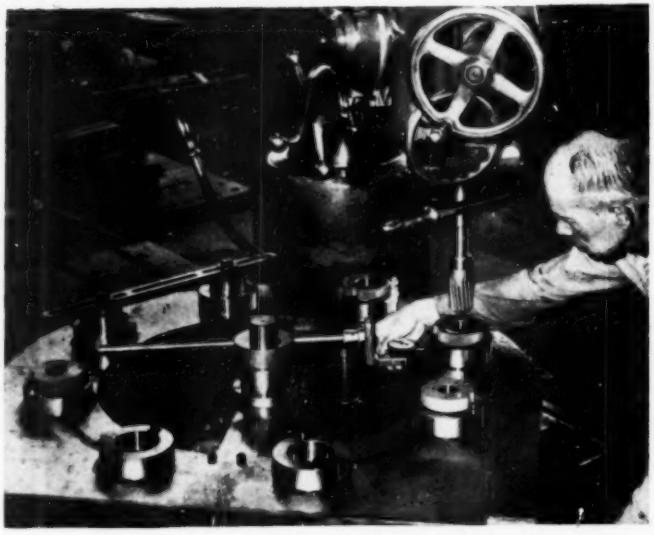
THIS BENCH FIXTURE RIVETS *a small sealing clip on the Type JA meter base. Vertical 3-in. stroke air cylinder at top of fixture is actuated, when workpiece is positioned to close a normally open Micro Switch under cylinder support plate, and operator has depressed plunger of second normally open Micro Switch with left thumb. As the operator must support the workpiece with the right hand, this setup insures that both hands are clear of the danger area when cylinder is actuated*



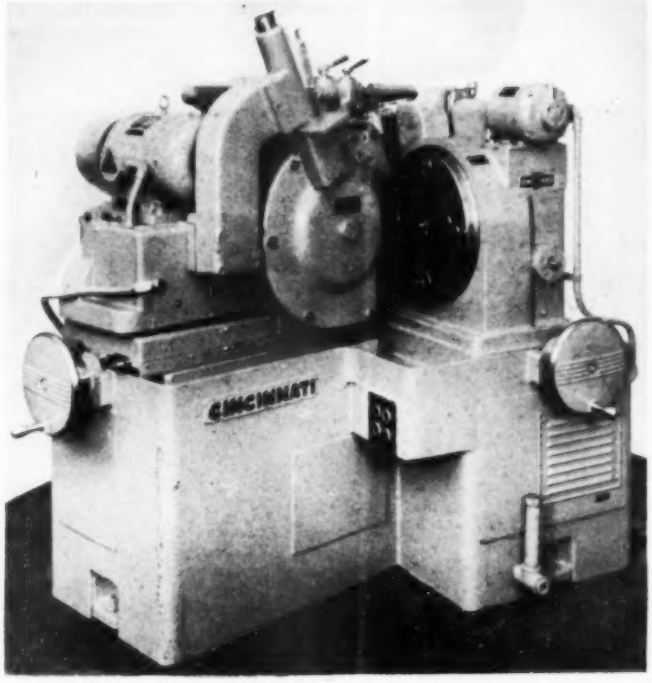
TWO-IN-ONE OPERATION *rivets a large sealing clip and the cover door on the base of the Type JA meter. Both a vertical 4-in. stroke cylinder and a horizontal 6-in. stroke cylinder are actuated when Micro Switch inside fixture is closed by insertion of workpiece and outside switch is closed by operator's left thumb. A single solenoid valve controls both air cylinders*

☆ TALENTED TOOLING

TOOLMAKER'S BUTTONS CONTROL DRILL JIGS

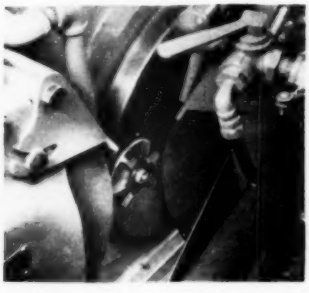


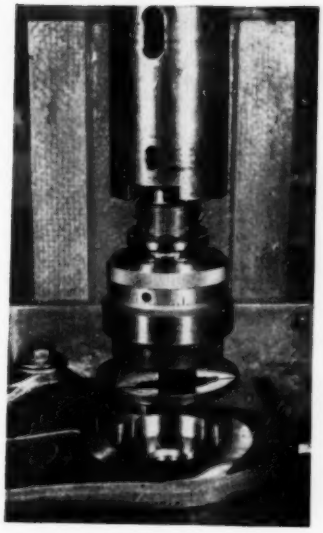
Accurately spaced holes on large bolt circles are drilled with 5-in. toolmaker's buttons bolted to the work. Bores in the buttons are 3 in. and finished for slip drill bushings. Center post fixed to the plate through a bolted-down bridge supports a swivel arm that carries a dial indicator. This checks radial placement of the buttons. Chord distances are checked with two plugs clamped in a connecting arm. The method is accurate to a thousandth on 85-in. circles. *Westinghouse Electric-Sunnyvale*

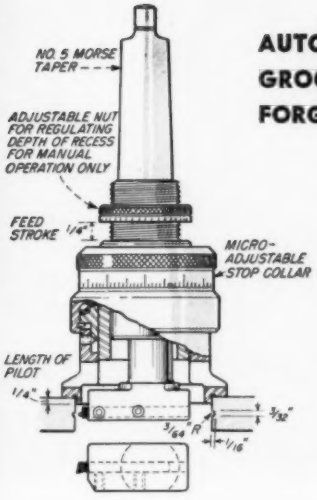


IMPELLERS PRODUCED BY DOUBLE-GRINDING

Two grinding wheelheads finish 15° slanted edges and OD's on water-pump impellers simultaneously. Indexing plate fixture carries four work spindles which rotate only at the grinding station. Both wheels run independently and are separately adjustable. Loading is done on exposed station opposite grinding station by fitting impeller on fixture stud and tightening knurled nut. *Cincinnati Milling*

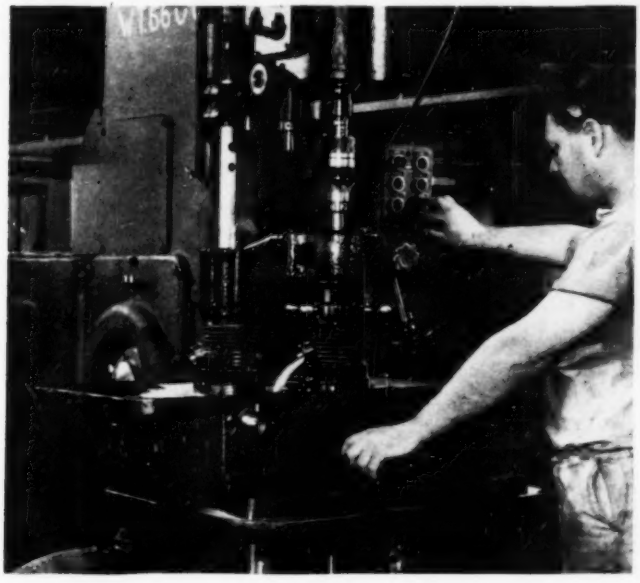






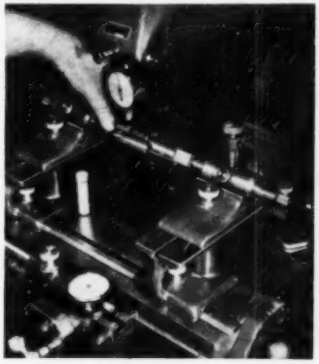
AUTOMATIC RECESSING TOOL GROOVES FORGED LINKS

Grease grooves in extra-heavy forged links were cut at 100 rpm with a special inclosed head that doubled production. A locating ring above the cutter positioned the head on the top surfaces of the machined links before cutting started. Grooves were midway down the 4½-in. bores, were 1/16 in. deep, 3/32 in. wide, and radiused. Cost savings on 3000 units paid for the head, which was adjustable and suitable for other jobs. *Scully-Jones*



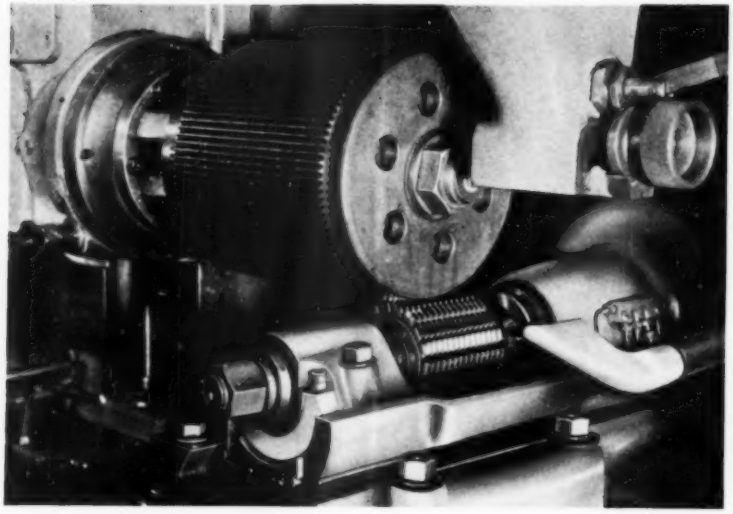
MOTORCYCLE CYLINDERS HONED AT HIGH SPEED

Double-fixture setup on Barnesdril machine hones cylinders for lightweight motorcycles. Operator unloads and reloads one fixture while honing cycle progresses at other fixture. Cutting fluid is drained to magnetic drum at left which separates chips from the kerosene. High-speed operation reduces cylinder cost. *Harley-Davidson*



FLUTE-TO-CENTER CHECK MEASURES TAPS

Three-fluted taps of all sizes are checked by measuring from one flute to the center in a single-wire setup. Adjustable clamped centers hold a tap while a dial-indicator reading is taken off a standard plate that is suspended to touch the wire. Tap is rotated in the setup for checking all three flutes. Distance to the centerline is checked with a master plug gage or with an arbor and gage blocks. *Warner & Swasey*



Multiple-thread hobbing reduced cutting time from 1 hr 35 min to 61 min for 8-blank load of 12/14-pitch, 105-tooth forgings. Formerly cut with 2¾x2¾ in. single-thread hob, gears now are climb-hobbed with double-thread hob, 4 in. in dia by 4 in. long. Feed is 0.054 in. per rev and hob speed is 139 rpm. Gears cut per shift increased from 16 to 40 and shifts per grind from 10 to 20, with two-thread hob

HOW DO MULTIPLE-THREAD HOBS BEHAVE?

PART 1

Knowledge of the effect of multiple threads on gear-tooth quality will guide users in selecting proper applications, thereby obtaining increased output

BY J. P. BREUER, Hob Engineer
BARBER-COLMAN CO.

ACCURACY and finish required on gear teeth are often the determining factors in planning hobbing applications. Directly related to these factors when multiple-thread hobs are under consideration are the number of teeth on the gear, and the number of threads and number of gashes in the hob. Understanding the relationships among these variables enables reliable predictions on the form, spacing, and surface finish of gear teeth generated with multiple-thread hobs.

It must be stressed at the outset that multiple-thread hobs are primarily a high-production tool, used in most cases for pre-shaving or pre-grinding operations, and that they are inherently less accurate than single-thread hobs. Properly applied, however, hobs with two or more threads give increased production and longer tool life because of increased diameter than do hobs with only one thread.

Work Indexes Faster

A conventional single - thread hob, for example, makes one complete revolution for each tooth in the work as it cuts. With a 40-tooth gear, the hob makes 40 revolutions for each revolution of the work. But the hob with more than one thread makes one complete revolution for groups of gear teeth equal to the number of threads in the hob. A double-thread hob, for instance, makes one revolution for every two gear teeth. It is this increase in the speed of indexing the work that accounts for the increased output from these hobs.

The production increase, however, is seldom equal to the increase in the speed of indexing. This is because the feed must be slightly lower because of the greater chip load per tooth. Generally an over-all production rise of 40 to 60% is realized when a two-thread hob replaces a single-thread hob. It is further expected that percentage increases in production will be greatest for double-thread hobs, with the figure dropping appreciably as the number of threads is increased.

Tool Life Often is Greater

Assuming that feed is reduced to maintain chip load per tooth at a point where best tool life is obtained, or that the diameter of the

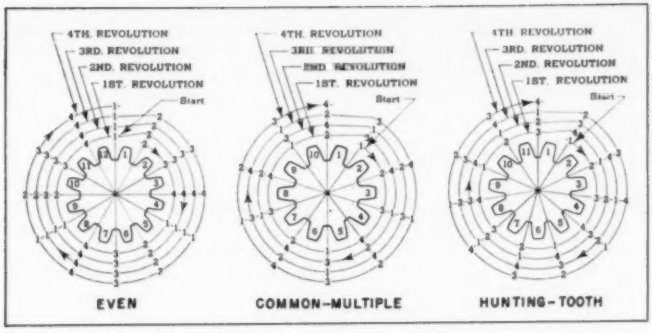


Fig. 1 . . Ratios between number of threads in a hob and number of teeth in a gear fall into three possible combinations: even, common-multiple, or hunting-tooth. In the "even" ratio, teeth divided by threads equals a whole number ($12 \div 4 = 3$, left) and same threads mesh with same teeth on each revolution. For the "common-multiple" ratio, teeth divided by threads equals a mixed number, but both are divisible by a common multiple: $10 \div 4 = 2\frac{1}{2}$, but common multiple $= 2$, center. Groups of teeth equal to the multiple (2) mesh with pairs of threads (1-3 and 2-4). "Hunting-tooth" ratio is a mixed number and there is no common multiple: $11 \div 4 = 2\frac{3}{4}$, right.

hob is increased to increase the number of hob teeth in action, it is often found that a multiple-thread hob will produce more gears than a single-thread hob of the same length. Accounting for this is the "shearing" cut, caused by the high lead, and the smoother cutting action. The "roughing" action, or the removal by one tooth of the maximum amount of metal during the generating process, is not all accomplished on one side of the hob. As there is one tooth in each thread that will be approximately on center, this "roughing" action is distributed among all threads, one-half, one-third, or one-fourth of the circumference of the hob apart, depending upon the number of threads. This makes for a much smoother cutting action.

Less Accuracy Is Expected

Theoretically ideal conditions for the accuracy and finish of gear teeth would exist if a hob were a worm with an infinite number of teeth located on a true lead. These conditions are approached in practice only in varying degrees and are more difficult to attain in multiple-thread hobbing.

In the first place, it is impossible with present methods to manufacture a hob without some lead error. On single thread hobs in some pitches this element may be controlled within ±0.0002 in. But on hobs with two or more threads, axial pitch limits between the several threads cannot be held to the same close tolerances.

Secondly, in generating a gear tooth, the finish on the tooth form is affected by the number of teeth in action. Because of the higher lead angle in a multiple-thread hob, fewer teeth contact each tooth in the gear. Generating flats therefore are more pronounced. Furthermore, the generating flats will vary according to the relationship between: (a) the number of threads in the hob and the number of teeth in the gear, and (b) the number of gashes in the hob and the number of teeth in the gear.

Even Thread-Gear Tooth Ratio

Consider hobbing as analogous to a worm and worm gear in mesh. If the worm has but one thread, it is apparent that the thread will mesh with every tooth in the gear, imparting its shape characteristics to each and every tooth. But when another thread is added, each thread will be meshed with every other tooth as the gear makes one revolution. Shape characteristics

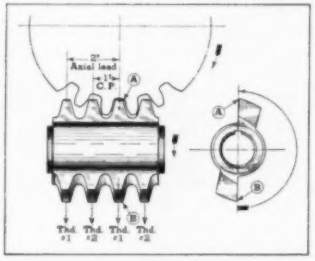


Fig. 2 . . "Even" thread-gash ratio of double-thread hob with two flutes permits centering one tooth on each thread. Tooth *A* in thread 2 is on center. As there are only two flutes, tooth *B* will be located diametrically opposite tooth *A*. In one-half revolution, *B* will be located in present position of *A* and will be on center between next two teeth in gear

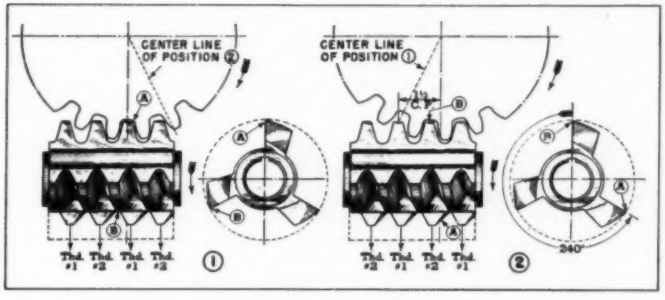


Fig. 3 . . "Uneven" thread-gash ratio of double-thread 1-in. C.P. hob with three flutes prevents centering one tooth in each thread on the gear teeth. In diagram 1, tooth *A*, in thread 2 is shown in initial position, on center, cutting in a radial plane. Tooth *B* in thread 1 is left of center. In diagram 2, hob has revolved 240° to place tooth *B* in radial position in cut. But gear has revolved 1 1/3 CP so tooth *B* is 1/3 CP (0.333 in.) past center when it is radial. Only when number of threads in hob is divisible evenly in number of gashes can a tooth in each thread be cutting on center in a radial position

of each thread then will act only upon alternate gear teeth during one revolution of the gear.

Whether or not the worm threads will continue to act upon the same gear teeth during the second and all succeeding revolutions of the gear depends upon whether the number of teeth in the gear is odd or even. For example, if a gear has 30 teeth, each thread will mesh with the same teeth on each revolution. If, however, there are 31 teeth in the gear, the thread starting with gear tooth 1 meshes with every other tooth up to and including tooth 31. The next tooth in mesh, during the second revolution of the worm gear, is 2. The 15 teeth that were not meshed during the first revolution (2, 4, 6, etc.) are then engaged by the thread. This process repeats itself, advancing one tooth after each revolution of the worm gear.

Three Combinations

Likewise, if two threads are added, the same principles apply. Therefore, it is apparent that if the number of threads in a multiple-thread worm is divisible evenly into the number of teeth in the gear (i.e., the quotient is a whole number), each gear tooth is acted upon by the same thread on each successive revolution of the gear. And if the number of threads is not divisible evenly into the number of teeth (i.e., the quotient is a mixed number), each gear tooth is acted upon by a different thread on each succeeding revolution.

If, however, the number of threads in the worm is not evenly divisible into the number of teeth in the gear, but the number of threads and the number of teeth have a common multiple, then groups of teeth equal to that multiple will be acted upon by the same threads. These threads will alternate in meshing with the same teeth on successive revolutions. This is illustrated in Fig. 1-center, which shows a four-thread worm meshing with a ten-tooth gear. Although the number of teeth (10) is not evenly divisible by the number of threads (4), they have a common multiple (2), so

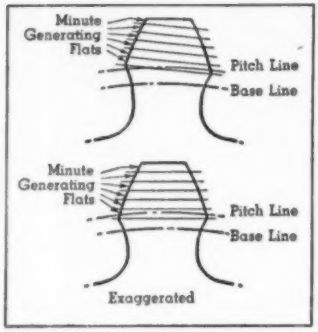


Fig. 4 . . Generating flats vary in location depending upon whether or not hob tooth is centered. Top diagram, showing undercut profile, is exaggerated example of how undercut is changed when tooth is not centered

groups of threads (threads 1 and 3; threads 2 and 4) will alternately mesh with a group of teeth equal to the multiple (2).

In hobbing, as in the above analogy, one of three conditions exist, depending upon the ratio of hob threads to gear teeth.

(1) Index and shape characteristics of particular threads act upon groups of particular teeth, when the number of threads is evenly divisible into the number of teeth to be cut. Shown in Fig. 1, this is called the "even" thread-gear tooth ratio.

(2) Index and shape characteristics of groups of particular threads act upon groups of particular teeth, when the number of threads is not divisible evenly into the number of teeth to be cut, but where there is a common multiple. Termed the "common-multiple" ratio, this is shown in Fig. 1-center.

(3) Index and shape characteristics of all threads act upon each and every tooth in the gear when the number of threads in the hob is not evenly divisible into the number of teeth to be cut and there is no common multiple. Referred to as the "hunting tooth" ratio, this is at right in Fig. 1.

"Hunting tooth" action automatically produces accurate tooth spacing and uniformity of shape regardless of the peculiarities that may be introduced through errors in the hob, improper sharpening, or incorrect mounting of the hob. But lead errors in the hob generally will show up as profile irregularities in the gear teeth. These profile errors invariably exceed those that result if only one thread is in action upon a given tooth.

On the other hand, with an "even" thread-gear tooth ratio, an accurate profile is produced on the gear teeth, but the spacing between the threads is reproduced directly into the work in the form of spacing errors. This, of course, is a more serious error, as it is difficult and sometimes impossible to correct by shaving. In either case it is well to leave approximately 50% more stock for finishing when multiple-thread hobs are used, depending, of course, upon the quality requirements and the method to be used for finishing.

Even Thread-Gash Ratio

The second important consideration in multiple-thread hobs that influences gear quality is the number of gashes. To obtain symmetrical generating flats, located evenly on both sides of each gear tooth, one tooth in each thread of the hob must be centered on the gear blank. This can be done only if the number of threads in the hob is divisible evenly into the number of gashes.

For example, consider a 1-in. circular pitch, double-thread hob having only two gashes for hobbing a gear with an even ratio of teeth, Fig. 2. Assume that tooth *A* on one thread is on center. As the number of threads (2) divides evenly into the number of gashes (2), there is a tooth in the second thread (tooth *B*) diametrically opposite tooth *A*. When tooth *A* is cutting on center in a radial position, tooth *B* will therefore be located 180° from *A*. As the axial lead (the advance of a point axially during one complete revolution of the hob) is 2 in., then tooth *B* advances axially 1 in. during a half revolution. It then assumes the former position of tooth *A*, on center.

If, however, there are three gashes in the hob with two threads, there is no tooth located diametrically opposite tooth *A*. This is shown in Fig. 3, which illustrates an uneven ratio between the num-

ber of threads and the number of gashes. Tooth B is located 240° from tooth A. When tooth B makes two-thirds of a revolution and the face of the tooth is cutting in the radial position, it will be located 0.333 in. off center. In other words, the cutting action is either delayed or advanced from the exact moment and point where the tooth is centered between two teeth in the gear. Hence, if the number of threads in the hob is evenly divisible into the number of gashes, a tooth in each thread may be centered. If not divisible evenly, only one tooth of one thread may be centered.

On gears 20 pitch or finer, having more than 20 teeth, or even on fairly coarse pitches where large numbers of teeth are involved, the generating flats blend into smooth curves and are usually neither visible nor measurable. Therefore, for all practical purposes, there is no point in trying to locate the flats at equal points on each side of the gear teeth.

But on gears and pinions having small numbers of teeth or on those having an undercut on the profile or chamfer, Fig. 4, symmetrical generating flats may be necessary. When using protuberance-type pre-shaving hobs, for instance, if the undercuts are not held symmetrical there may be interference with the shaving cutter at the bottom of the gear tooth on one side as it approaches finished size.

With a single-thread hob it is always possible to center the hob tooth on the blank and thereby obtain symmetrical generating flats. But with multiple-thread hobs centering one tooth in each thread requires that threads are evenly divisible into gashes. It is not always possible, of course, to select a number of gashes on this basis because it is desirable to use the maximum number commensurate with good tooth design, regardless of whether or not it is a multiple.

(Part 2 of this series will appear in a forthcoming issue—Ed.)

Universal Dies for Short-Run Jobs

BY FEDERICO STRASSER

MARKET-conscious manufacturers know how important it is to shorten the time needed between the end of experimentation and output of new products. Often, a few lost weeks mean the difference between commercial success and failure. The answer to this problem in many cases lies in the use of universal dies.

These dies consist of standard parts (see Fig. 1):

1. Die proper, preferably with die-holder base.

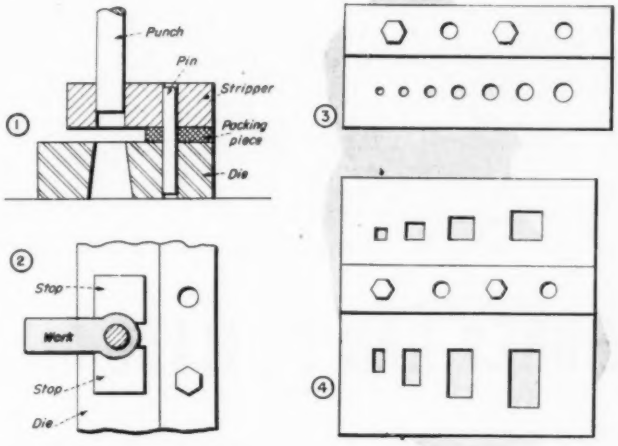
2. Punches with punch-holder; better several holders, instead of a single universal type, in order to avoid bending stresses caused by non-uniformly distributed load.

3. Stripper; if tool is not mounted in a dieset, the stripper should also guide the punches. Hence, its height must be greater than usual (1 in. approx) and the punches must have a snug running fit in it.

4. Stop to form an adequate nest or receptacle for the blanks to be punched, channels for passing strips, coils, etc; these stops are clamped on the die (Fig. 2).

5. Packing pieces, pins, screws.

Fig. 3 shows a universal die with a series of round holes, and Fig. 4, one with square and rectangular holes. The dimensions should be chosen in the same progression, and preferably round values, e.g., for round holes: 0.01, 0.015, 0.02, 0.025, etc.



Although always ready for use, after some slight work to apply stops, guides, etc., universal dies are slow and require skilled operators

Universal dies are generally employed for piercing, but sometimes may be needed for cutting off, shearing, and even blanking.

These tools are intended only for temporary use. Once the definitive features of the work are established, it is necessary to prepare regular dies.

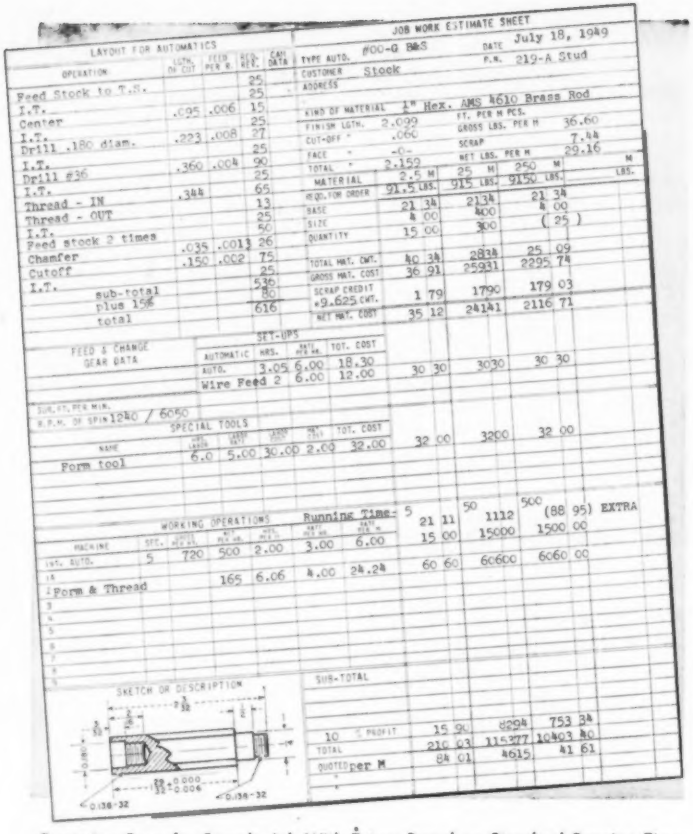
Taking into account the advantages and disadvantages of universal dies, their utilization is generally limited to:

1. Short-run stampings (chiefly punchings)

2. Experimental work with quite high accuracy requirements

3. Emergency substitution for common dies temporarily out of service.

4. When it is probable that some minor changes in design of the workpiece will soon be made.



JOB WORK ESTIMATE SHEET

LAYOUT FOR AUTOMATICS

OPERATION	LGTH. OF CUT	FEED PER R.	DIA. SIZE	CAL. DATA
Feed Stock to T.S.			25	
I.T.			25	
Center	.095	.006	15	
I.T.			25	
Drill .180 diam.	.223	.008	27	
I.T.			25	
Drill #36	.360	.004	90	
I.T.			25	
Thread - IN	.344		65	
Thread - OUT			13	
I.T.			25	
Feed stock 2 times			50	
Chamfer	.035	.0013	26	
Cutoff	.150	.002	75	
I.T.			25	
sub-total			536	
plus 15%			80	
total			616	

TYPE AUTO. #00-G B&S — DATE July 18, 1949
CUSTOMER Stock — P.N. 219-A Stud
ADDRESS
KIND OF MATERIAL 1" Hex. AMS 4610 Brass Rod
FINISH LGTH. 2.099 — FT. PER M PCS. 36.60
CUT-OFF " .060 — GROSS LBS. PER M 7.44
FACE " -0- — SCRAP 29.16
TOTAL " 2.159 — NET LBS. PER M

MATERIAL	2.5 M	25 M	250 M	M
REQ. FOR ORDER	91.5 LBS.	915 LBS.	9150 LBS.	LBS.
BASE	21 34	213 4	21 34	
SIZE	8 00	400	8 00	
QUANTITY	15 00	300	(25)	
TOTAL MAT. CWT.	40 38	2838	25 09	
GROSS MAT. COST	36 91	25931	2295 74	
SCRAP CREDIT @9.625 CWT.	1 79	1790	179 03	
NET MAT. COST	35 12	24141	2116 71	

FEED & CHANGE GEAR DATA

SET-UPS

	AUTOMATIC	HRS.	RATE PER HR.	TOT. COST
	AUTO.	3.05	6.00	18.30
	Wire Feed 2	6.00		12.00
				30 30

		30 30	3030	30 30

SUR. FT. PER MIN.
R.P.M. OF SPIN 1240 / 6060

SPECIAL TOOLS

NAME	LABOR	COST	LABOR	COST	TOT. COST
Form tool	6.0	5.00	30.00	2.00	32.00
					32 00
					3200
					32 00

WORKING OPERATIONS — Running Time- 5 — 50 — 500 — (88 95) EXTRA

	MACHINE	SPEC.	HRS. PER M	PCS. PER HR.	HRS. PER M	PCS. PER HR.	HRS. PER M
1	1st. AUTO.	5	720	500	2.00	3.00	6.00
2							
3	Form & Thread			165	6.06	4.00	24.24
4							
5							
6							
7							
8							
9							

	21 11	1112	
	15 00	15000	1500 00
	60 60	60600	6060 00

SKETCH OR DESCRIPTION

SUB-TOTAL

10 % PROFIT	15 96	1599	753 34
TOTAL	210 03	115377	10903 80
QUOTED per M	84 01	4615	41 61

Quotation Form for Sample Job With Extras Based on Standard Running Time

SAMPLE COMPUTATION
(Short Method)

Assume that we are to prepare a quotation on 2,500, 25,000 and 250,000 studs, which can be made on a No. OOG Brown & Sharpe automatic in a 5-sec cycle. Production is assumed at 720 pcs per hr, gross; 500 pcs per hr net. The estimated running time for the quantities imposed would be:

2,500.... 5 hr
25,000.... 50 hr
250,000....500 hr

If we assume a machine-hour rate of $3.00, the standard machining cost for the quantities concerned would be:

2,500.... $15.00
25,000.... 150.00
250,000....1500.00

The extra costs for these quantities based on the table, would be:

2,500.. $15.00 × 1.4074 = $21.11
25,000.. $150.00 × 0.0741 = $11.12
250,000..$1500.00 ×
(-0.0593) = -$88.95*

* Subtracted amount, because run exceeds 100 hr.

These amounts, added to or subtracted from the standard costs above, result in the following machining costs for the various quantities:

2,500.... $36.11
25,000.... $161.12
250,000....$1411.05

MONEY CAN BE MADE ON SMALL ORDERS

BY CHARLES D. HOYT, JR.
President, CHARLES D. HOYT COMPANY

Equitable pricing of various-sized orders, while overcoming losses from unmeasured idle hours, is a current problem. As president of the National Screw Machine Products Association, and chairman of its committee on statistics, Mr. Hoyt proposes a costing method that should be of interest to many besides members of his industry

How Big is a Small Order?

THE SMALL ORDER, like small business, is practically impossible to define because it is relative, and the relativity changes much too fast in the screw-machine products business. Further complicating the subject is the comparative flexibility of the customer in placing orders. For example, in 1944 a 100,000-pc run was a small order. In 1946 a 10,000-pc order was small. At times in 1949, a request for 1,000 pcs looks like a large order.

The problem therefore, is to make money on orders many times smaller than those the factory feels are minimum economical production runs. So, for the purpose of this discussion, a small order will be considered to be an order that is relatively small compared to a standard order to be defined later.

Nature of the Cost Problem

Although it is not possible to predict the size of orders either to be quoted or manufactured, it is

possible to price all orders equitably and consistently. When executives state, "Our shop cannot run an order for less than 25,000 pcs," they are unimaginative and headed for trouble. Numerical quantity of parts produced really has nothing to do with the matter. The true underlying factor is the elapsed time required to manufacture the order. And the elapsed time in turn determines the real conversion cost of the order, regardless of quantity of parts specified.

Buyers of screw-machine products ordinarily ask quotations on several quantities. Every bidder knows that the largest quantity requested is the juicy morsel, and the one that can be made most economically. On the other hand, the customer invariably orders a smaller quantity, hoping to get a "break" on price.

For any quotation the largest quantity means the longest run in terms of hours, and offers the opportunity to amortize grievous errors in setup and running-time estimates, and to engineer idle and downtime to a minimum. These starting load factors make the short-run order risky. But market conditions make it necessary for the customer to place such orders.

The factor often misunderstood by buyer and seller is the idle-time problem, which is what really makes the small order more expensive. Idle time may have nothing at all to do with the particular job that is being run, but mounts rapidly and almost in direct proportion to the number of different jobs being processed. Idle time is concerned mostly with closing out the preceding job, requisitioning Material, small-tool procurement, tearing down the machine, lack of sufficient setup men, and tools not ready.

A Practical Solution

Our objective is preparation of a table in which actual elapsed time will be related to estimated running time, and in which this ratio will be related to the same ratio for a certain standard or normal job. This table in the hands of the estimator will produce part prices independent of the number of pieces to be made, and therefore equitable and consistent from one order to another.

The Standard Order

First, find out how long most jobs run. This is determined by computing the weighted average running time of all the individual orders manufactured in the last 12 months. If the most frequent order is a 100-hr run, this is taken as standard for order costing. Such a job will be priced at basic normal machine-hour rates.

Computation of Estimating Table

Assume that idle time amounts to 8 hr per job. If running time of the standard order is 100 hr, elapsed time will thus be 108 hr. All shorter runs should cost proportionately more and all longer runs should cost proportionately less.

Use of Estimator's Table

In use, the estimator needs only columns 1 and 4 of the accompanying table, which can be expanded to any extent. The estimator multiplies the standard machining cost by the appropriate pricing factor from the table and adds or subtracts that amount to the standard machining cost for each quantity quoted. This amount added is the extra cost due to length of run.

If machine-hour cost rates are properly derived, and if a proper analysis of past orders is used, there is no reason why a 1-hr job should not return its proportionate share of profit.

From the customer's viewpoint, the objective is to pay the least aggregate net cost for parts. From the vendor's viewpoint the ultimate objective is the greatest aggregate net profit from all orders commensurate with good business practice. The method proposed here is an attempt to correlate both objectives.

What the Shop Can Do

Loss leaks can be stopped by analyzing the idle machine time, and by not maintaining on the payroll persons to supervise idle hours. Each screw-machine products plant can:

1. Determine average starting load effect on estimated net production per hour. This would involve analysis of various jobs to see just how many hours are required for a new job to reach maximum optimum production per shift.

2. Determine idle hours caused by an unbalanced labor supply, which might be indicated by too many setup men for a given number of operations. It should be remembered that too few setup men can be just as costly as too many.

3. Determine idle hours caused by management inertia causing poor planning, which results in loss of coordination of tools and material and manpower with available machine time.

4. Keep some simple record, after arriving at a minimum hour loss between the end of one job and the start of the next, to insure maintenance of that minimum; and set up accounting and costing methods which reflect this loss as part of the normal burden.

5. When runs get longer, make the necessary adjustments and pass the lowered cost on to the customer.

Pricing Factors for Costing Jobs of Various Runs

Estimated Running Time Machine Hr	Elapsed Time in Hr Col. 1 + 8 hr	Ratio of Elapsed to Running Time Col. 1 ÷ Col. 2	Pricing Factors $\frac{\text{Col. 3} - 1.08}{1.08}$
5	13	2.6000	1.4074
7	15	2.1429	0.9842
10	18	1.8000	0.6667
25	33	1.3200	0.2222
50	58	1.1600	0.0741
100	108	1.0800	0
500	508	1.0160	(0.0593)*
1000	1008	1.0080	(0.0667)*

*Quantities in parentheses are negative

ROUND TABLE

Brother's Keeper

"Remember Tom Matson, Al, the little short guy who pulled out of here about a year ago, and left some of the boys holding the bag?"

"Yes. He even borrowed money from several of us—owes me five bucks, as a matter of fact. I'd like to lay my hands on him again—I'd sure collect."

"Well, you'll get your chance—he was around this morning looking for a job. He's coming to work Monday."

"Don't think I won't get after him, either. I don't like to have guys walk out owing me money. He's got my little feeler gage too, come to think of it."

"Sounds like you're an easier mark than most of us, Al. The best he did around here was a buck or so—or a pair of calipers."

"Look, Ed, if he did this borrowing all over the place, why did you hire him back, just so the boys could get their dough?"

"No, Al, he's a darn good mechanic. He can make a shaper talk—and you should see him handle a 6-in. lathe. We can always use a good man."

"And you don't care who or what he is—as long as he is a good mechanic, eh? You figure that the boys have to watch their own step—just so you get the work out. That's a heck of a way to run a department."

"What business is it of mine if a guy sponges on the others? Let's not mix personal and company business, Al. If he starts 'borrowing' from the company, that's another thing."

"Then you figure it's none of your affair if he borrows everything he can from the boys, eh, just as long as he leaves company property alone?"

"That's right. It's not my business to run any man's personal life. As long as he does his job, that's all I'm responsible for. If I lend him some of my own dough or tools, then I've got nobody to blame but myself."

"But, Ed, you've got some responsibility towards the other men. If you hire a guy, you automatically throw him into daily contact with the others. If he's a wrong one, and you know it, then it's your job to turn him down."

"Not if it's personal business, Al. He can do whatever he wants to in his personal life, as long as it doesn't queer things in the shop."

"But it does, Ed—you louse up morale the minute you bring him in—and you don't help the boys' opinion of you either . . ."

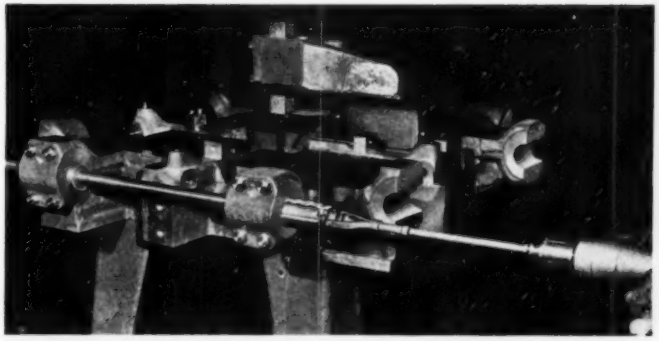
"What am I, Al, my brother's keeper?"

***WHAT ABOUT THE MAN** with known or suspected bad personal habits? Should they be considered when he is hired? Or is personal business personal business? Your ideas and opinions on this subject will interest others. Discussions of earlier topics appear on later pages.*

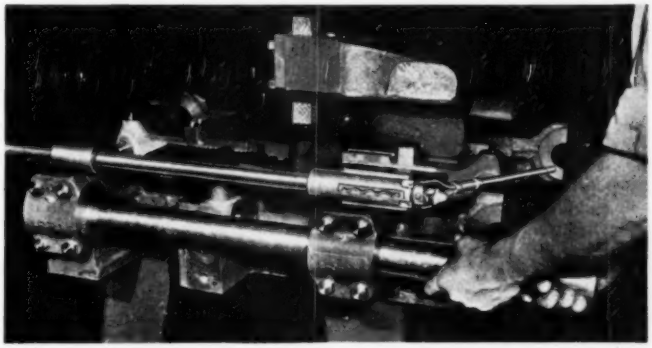
Special Hone Aligns Machine Bearings

Camshaft alignment is highly important on four-slide machines. Here's how one builder solved the problem and saved money at the same time

BY H. J. NILSON, President
A. H. NILSON MACHINE CO.



Align-honing with this simple and inexpensive setup reduces bearing fitting time to one eighth and permits use of commercial ground shafts



Test bar is only 0.001 in. smaller than finished bores, but slides freely into place. Hone can be seen lying on top of journal boxes

EXTREME accuracy of alignment is essential in fitting the four rotating camshafts of four-slide machines for wire and metal forming. These shafts are located in two cast-iron journal boxes on each of the four sides of the machine and are driven, one by the other, through miter gears, to operate and synchronize the various tools.

Conventional practice has been to hand scrape each bearing, a laborious process involving repeated placing and removing of the heavy shaft, and requiring the services of two men for two hours to complete one machine.

To reduce this time, and at the same time to insure accurate alignment, engineers at A. H. Nilson cooperated with Sunnen Products Co. to develop a special alignment hone. This has three different size heads to cover a line of 30 different models of machines with bearing diameters ranging from 1⅜ to 4½ in., and with center distances varying up to 40 in.

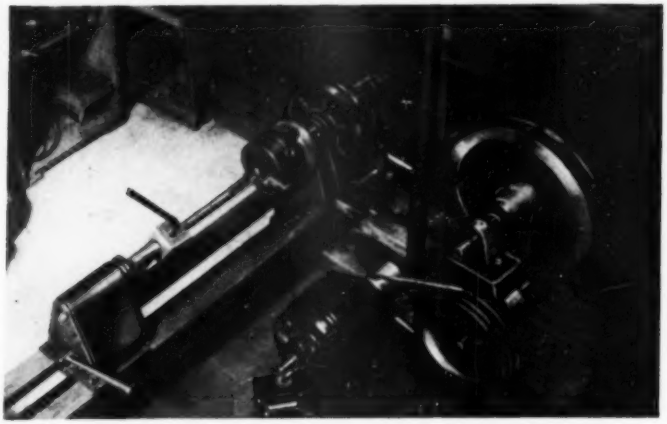
The honing head is attached to an alignment bar and is exactly concentric with it. It is driven by a portable electric drill through a shank and universal joint. In operation, a tapered bushing is inserted into one of the rough machined bearing holes, just tight enough to prevent it from rotating. The alignment bar is entered into the hole in the bushing, in which it has a 0.001-in. running fit, and the two stones and two guide shoes of the hone are expanded to fit into the hole to be honed. As the honing head is rotated it is stroked back and forth by the operator until desired size has been attained.

For the second hole of the pair, the same bushing is inserted in the finished hole and the operation repeated. The bushing is designed so its length and taper compensate for the difference between rough and finished size.

To check for alignment, a master shaft 0.001 in. smaller in diameter than the honed holes is slid through the pair of bearings. If a looser running fit is required, honing is repeated until proper size is reached. The operation is performed dry with 220-grit stones and gives a finish of 16 to 24 mu in. rms. With finer-grit stones, a 5-mu in. finish can readily be obtained. Only one man is required, and he can complete the four sets of bearings in ½ hr.

A further advantage of this process is that it permits the manufacturer to use commercial ground shafting for the shafts, and to hone the bearings to suit. Previously it was necessary to grind each shaft to close limits because scraping could remove only small amounts of material. Commercial ground shafting has a ±0.0015-in. limit, and this is easily taken out with the hone.

Practical Ideas



Large Power Tapping Machine Made From Cast-Off Parts

LACKING a power tapper large enough to handle some ⅞-in. nuts that were urgently needed for a short-run job, we threw together a tapping setup from scrap parts in short order. The outfit served for the original job, and has been used ever since with good results.

Power is taken off a 1450-rpm motor mounted on a bench. This drives a second shaft through a V-belt that turns a pulley and an auto-starter pinion. The pinion meshes with an old auto flywheel that, in turn, rotates a sprocket and chain drive to a sprocket in the headstock of an old 5-in. center lathe. The various stages reduce the speed to 25 rpm, although this can be changed by using pulleys of different sizes for the V-belt.

The small chuck that holds the work is mounted on ¾-in. "stilt" blocks that hold it out from the faceplate of the lathe. This allows adequate chip clearance.

The tap is held in a noseblock that is fitted with a straight shaft that fits the tailstock center, which is not tapered. The block can be moved forward and back, so it can go full depth in the chucked work and then be retracted to clear.

A length of hex stock, bent and with a thread on the end, works in a tapped hole in the top of the block to clamp on the flat on the tap. Another threaded rod, not bent, comes into a tapped hole under the noseblock. The lower end of the rod is fitted with a roller grip that rests on the lathe bed. This steadied the tap and makes the work quite accurate.

The tapping cycle goes like this: Operator starts motor with push-botton switch next to motor, advances tap into work by pushing on the two rods or handles, and daubs sulphurized cutting oil on the tap flutes with a brush.

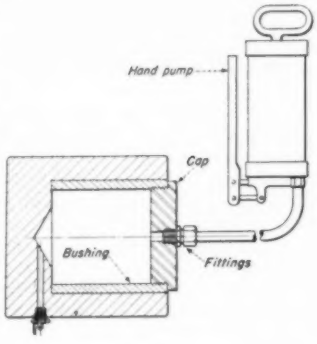
When the tap is through the work—this can be judged by the sound of the load on the gearing—the spindle is stopped and the chuck jaws are released. The tap is retracted with the work still on it, and tap and chuck are cleaned and a new part is chucked. The cycle is started again, and while the tap is cutting into the second part, the first part is spun back onto the tap shank. This is repeated until the tap shank is full of parts. Then the tap is released, workpieces are removed, and the cycle is started again. *Dan Penway, Carlisle, England.*

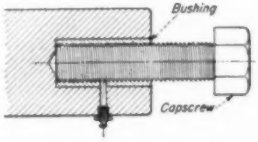
Hydraulic Pressure Releases Old Frozen Bushings

TO GET old bushings out of blind holes in machine members that cannot be set up on machine tools so the bushings can be cut out, it is often easiest and fastest to use hydraulic pressure.

Large bushings can be tapped and threaded caps inserted as illustrated. Hose fittings to a hand pump are provided so the cavity can be filled with oil or water. As the pressure rises, the force against the cap increases until the bushing pops out. Some sort of guard should be set up to catch the bushing as it is released.

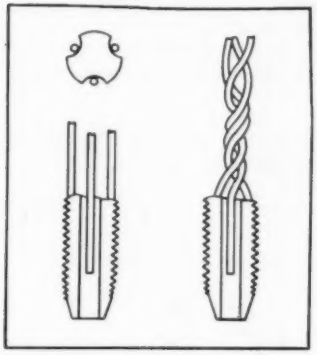
Smaller bushings can be tapped to full depth for a close fit around a capscrew. When the screw is tightened on the cavity, which must be filled with fluid, the internal pressure again forces the bushing





out. Grease or old gear-box oil is good for this purpose.

With either method, care should be taken so the operator is not in the way in case the bushing gives way suddenly. *Enrique Peyrani O., Monterrey, N. L., Mexico.*

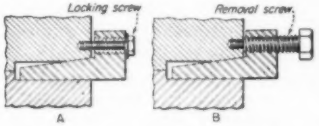


Three Wires Twist Broken Tap Out of Threaded Hole

ALTHOUGH this may not be a new idea to old timers, broken taps can be removed from holes where they have broken off by a three-wire method.

Lengths of piano wire (it can be annealed) are slipped between the tap's flutes down as far as they will go, then are twisted together. Usually they will have enough strength to lift the tap when they are twisted with pliers. *D. H. Richford, London, England.*

TUBING or round stock can be turned or twisted easily if a round file is gripped by a monkey wrench with the tubing. This is done by opening the wrench larger than the tubing, placing it to full depth of the jaws on the tubing, then positioning the file against the outside jaw next to the tubing. This approximates the action of a pipe wrench, but it reduces scoring of the tube because a fine file can be used. *Federico Strasser, Santiago de Chile.*

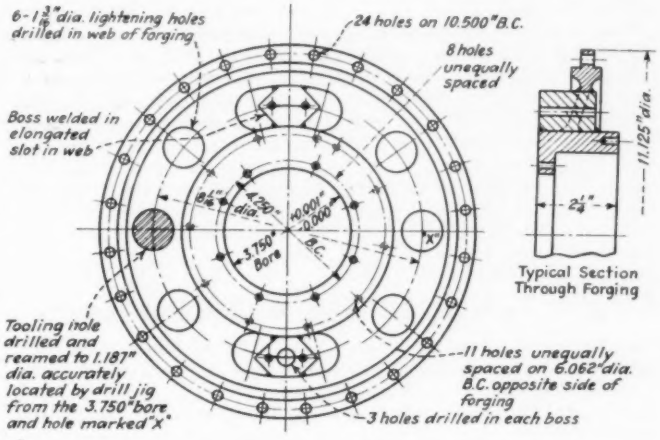


Tapped Gib Head Simplifies Assembly and Removal

I HAVE found that by not cutting the 45° angle on a gib-head key and leaving the head rectangular, enough stock is left to allow drilling and tapping a hole for a capscrew.

For assembly, the key is simply tapped into place by hammering on the lower part of the head, away from the hole. If the key should be locked tightly in place, a second hole is drilled and tapped, in line with the one in the head, in the hub. This thread should have an OD slightly less than the ID of the thread in the key so a small screw can be assembled to lock the head.

When the key is to be removed, a headless setscrew the same size as the small capscrew is assembled into the hole in the hub, and a large capscrew that matches the thread in the head is driven in against the setscrew to force the key. *Ray Cafiero, Brooklyn, N. Y.*


6-1 3/16" dia. lightening holes drilled in web of forging
24 holes on 10.500" B.C.
8 holes unequally spaced
Boss welded in elongated slot in web
.4250" dia.
.8125"
3.750" Bore
+.001" -.000" B.C.
X
11.125" dia.
2 1/4"
Typical Section Through Forging
Tooling hole drilled and reamed to 1.187" dia. accurately located by drill jig from the 3.750" bore and hole marked "X"
11 holes unequally spaced on 6.062" dia. B.C. opposite side of forging
3 holes drilled in each boss

Revised Drilling Method Eliminates Slow Layout Work

THIS IDEA has eliminated considerable layout time per piece where several holes on various bolt circles had to be drilled. It also eliminated error on the part of the drill operator is locating plate drill jigs over the parts.

The work is a forging that has two slots milled in a web section and with two bosses welded into the slots. The location of the six 1 3/16-in. lightening holes is not important, but all other holes had to be accurate.

Originally these forgings were produced by another shop. The six holes were drilled and the slots were milled after rough machining. Then the bosses were welded, the parts stress-relieved, and then the forgings were finish-machined. Finally, centerlines were marked on the part, and these were lined up under the plate jig.

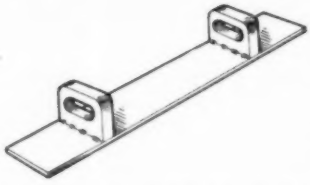
This was slow work, and in our shop we changed the method. The preliminary machining and drilling is the same except that we drill only five of the lightening holes. After final machining, a simple jig is used to locate the sixth hole (shaded) from the 3.750-in. bore and it is drilled. Finally, another plate jig locates the part by the bore and the sixth hole for all the other holes and the part is done.

The method does away with a lot of fussing around that was required to locate a layout on the part in relation to the plate jig, and it eliminates layout time entirely. The tooling hole (the sixth) was drilled and reamed after stress relief to eliminate error due to distortion because of heating and welding. *Clement F. Brown, Willow Grove, Pa.*

Spotweld Tacking Simplifies Assembly Fixtures

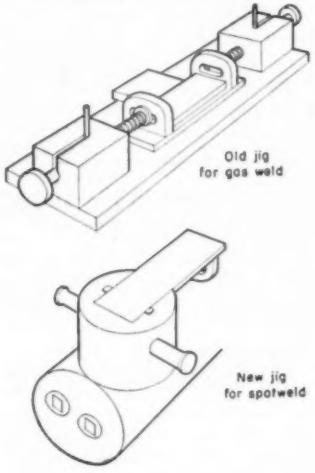
PRODUCTS that have to be welded during assembly are frequently tacked with a gas torch in a locating fixture, then removed from the fixture and completely gas welded on a bench. This calls for a complicated fixture that will hold all the parts; and one that often needs repair because of the frequent heating and cooling.

When a plant has a spotwelding department, many of these tacking jobs can be done on a spotwelder with a simpler jig. Spotwelding is simple, too, because a torch does not have to be manipulated around extending fixture parts—the tacking fixture has to be designed to allow space for the welder, and therefore the operation itself is quite a bit faster.



An example of this idea is the work illustrated . . . a flat piece with two handle-like extensions welded in place. At first the tacking was done with a torch. A heavy plate fixture with end locaters and a center locater was required to hold the part right side up. But tacking is now done on a spotwelder with a simple fixture that holds the work upside down, exposing it for the welder. The fixture is actually part of the lower electrode, and it locates each of the extensions in a cavity. The flat base is located in relation to each handle in turn.

With the new method, the stainless-steel parts are produced with fewer rejects, and at a rate of 300 per hour as opposed to five per hour with the old method. *Aaron H. Shum, Los Angeles, Calif.*

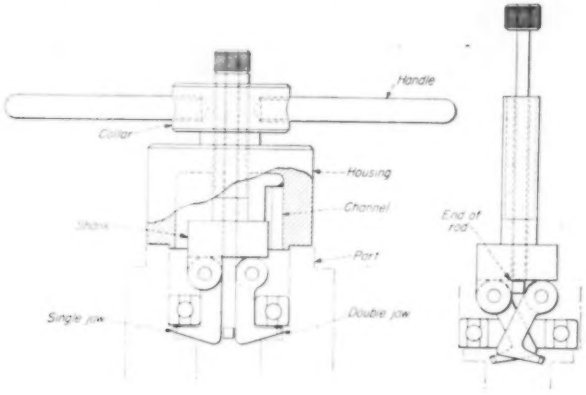


Scissor Extractor Lifts Ball Bearings

BEARINGS that are fitted into hard-to-reach bores can be removed with an expanding extractor. Such bearings must be lifted by pressure against the outer rings, which are pressed into the bores; therefore the extractor has jaws with welded tips that do all the contacting.

Three jaws are pinned into the end of a threaded shank—one jaw is opposite a space between two others, so the single jaw can collapse into the space. A long rod through the bore of the shank presses against the backs of the jaws to extend and hold them once they are inserted below the bearing.

A heavy collar with two handles is assembled on the threaded section of the shank to exert pressure on the housing that contacts the main body of the part. A channel piece is welded to the housing to fit in a slot in the wide part of the shank. This prevents rotation of the housing, which is bored to clear the thread on the shank. *R. B. Wolverhampton, Staffordshire, England.*

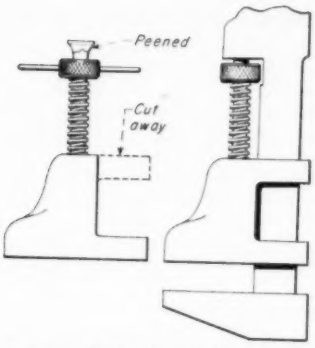


Weight Control Checks Sizes Of Mirrors for Products

A NEW PROBLEM was introduced to our factory when a shipment of mirrors for assembly into a metal shell was received. The mirrors were uniform in length and width, but their thickness varied.

In order to check thickness for inspection, we tried first a fixed gage, then a micrometer. The gage scratched the glass, and the micrometer was too slow. It occurred to me that we could weigh each mirror and convert weight readings to thickness with little expense.

I used a small table scale with a zero reading in the center. A mirror with the maximum amount of allowable thickness was placed on the left pan, and mirrors to be checked were placed on the right pan. Any mirror was acceptable if the scale pointer went to zero or to the left of zero—if the pointer went to the right side, the mirror was overweight and was rejected. *Fred Lettino, Astoria, L.I., N.Y.*



Salvaged Monkey Wrenches Make Good Jacks

THE OLD monkey wrench is getting to be an obsolete tool nowadays. It is being replaced by spanner wrenches, large crescent wrenches, and socket wrenches. Consequently, in many shops, back shelves in tool cribs and lower drawers in machinists' benches hold battered monkey wrenches of all sizes.

Small but powerful jacks can be made from these old wrenches by cutting away most of the wrench bodies and salvaging the adjustment screws and nuts. The adjustable jaws can be cut away and ground to flats on the bottom, and pins can be inserted in the knurled nuts as illustrated. The nuts can be retained on the screws by peening over the ends of the screws. *George F. Burnley, Oakland, Cal.*

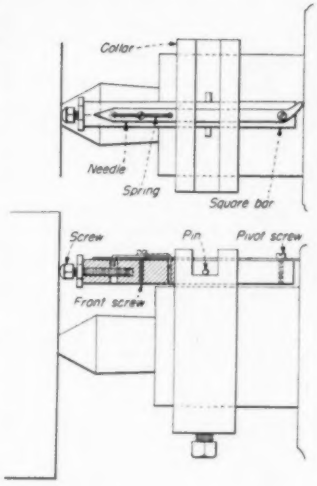
Swinging Needle Indicates Lathe-center Tightness

BIG JOBS on the lathe often have to be left in the setup for days, and in a case like this, damage to the center would be costly. An easily made indicator will show when center pressure is excessive.

The body consists of a collar that is tightened on the end of the tailstock spindle. A longitudinal bore through the top of the base admits a square-section bar that is held in place by a cross pin. A round-head screw is fitted to the end of the bar to rest against the work above the center.

The needle, made of sheet metal, is pivoted in the bar by a screw near the tailstock housing, and the portion that touches the housing is offset to provide torque. A front screw in the bar clears the needle and confines a spring that is wrapped around it. The rear end of the spring fits in a tight hole in the bar and clears the needle, while the front part fits in the needle and clears the bar.

Pressure against the rounded adjusting screw forces the bar back and the needle is twisted by pressure against its rear end. This moves the tip of the needle against spring pressure to indicate a change in center pressure. The adjusting screw should be set so the needle will fall on an index line when pressure is correct. *H. Moore, Hamilton, Ontario.*



Shop Slotter Constructed from Welded Frame and Shaper

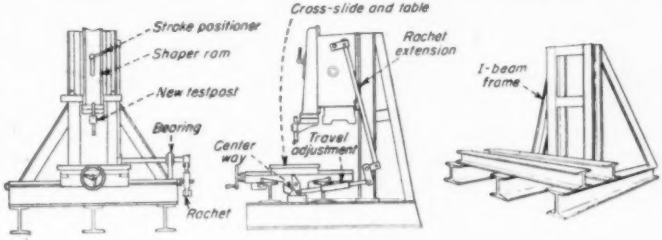
CUMBERSOME work can be handled in a small shop by converting a shaper into a small slotter. This can be done by welding together a stout I-beam frame, attaching the shaper vertically to the frame, and mounting a suitable table on the lower base of the frame.

The normal shaper table and ratchet are removed, and the toolpost is replaced by a conventional slotter type. Ways for the table are built directly on the I-beam frame—two tilted outside ways, and one V-way in the middle. The table itself is mounted on a cross-slide that rides on the ways. Cross-slide movement is manual through a suitable handwheel and screw that connects with a bronze nut fixed to the table.

Longitudinal travel of the slide is controlled by the original ratchet arrangement, which must be extended and relocated. One or two bearing blocks are added to support the shaft from the ratchet to its extension which connects with the shaper proper up on the frame.

A gibbed table prevents any lifting motion of the table, and holddowns attached to the bottom slide keep the slide assembly from lifting off the ways on the frame. An additional change that will be necessary is to rearrange the oiling system for the shaper, which is now vertical instead of horizontal.

Such a machine, if it is built with some care and if the components are in good condition, can approximate the capacity and accuracy of a factory-built slotter. *Lowell F. Stull, Youngstown, O.*



$25 *In addition to regular payment*

for the best

PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

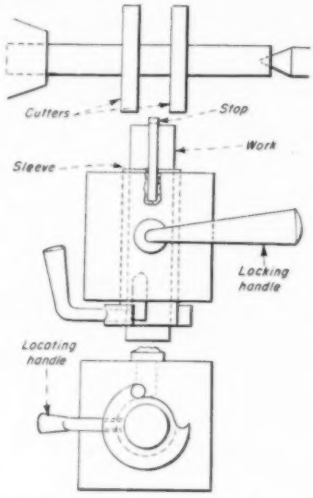
REQUIREMENTS — Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author —every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product — in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

85th Winner:

Edward Farrell
Channel Planing
R. B. Wolverhampton
Universal Tapper



Lathe Takes Over Mill Job To Balance Machine Load

IN ORDER to balance our machining load we had to design tools and fixtures for milling work to be done on a lathe. One of these setups was a straddle-milling job that turned out to be just as efficient on the lathe as on a mill, and was easier on the operator.

The work was milled square by two cutters mounted on an arbor carried between a tailstock center and a chucked adapter. Round stock was inserted in the sleeve against a welded stop, the sleeve was locked, and one cut was made. Then the sleeve was partly released so it could rotate—but not release the work—and was moved to the second position, 90° from the first.

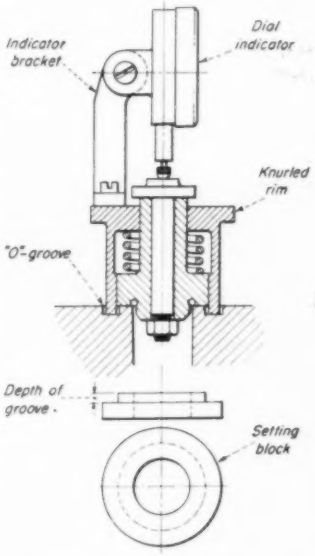
A pin in the fixture base stopped the sleeve at each end of a slot to locate the work rotationally. This produced squared ends. *Lyle C. Vinger, Waukesha, Wis.*

RUSTY SCALES, dials, and calibrations can be read more easily if all the dirt and oil is rubbed off and chalk is applied. After the excess has been wiped away, the lines will show up white, even though the surfaces beside the lines are still rusty. *Federico Strasser, Santiago de Chile.*

Indicator Gage Checks Grooves

O-RINGS and packings are frequently employed with high-pressure hydraulic equipment. These rings and packings are clamped into circular O-grooves, the depth of which must be controlled and inspected closely to prevent blowouts when the packings are under pressure.

This gage speeded inspection of the grooves by accurately gaging their depth. The spring-loaded plunger is set down on the surface of the work, where it acts as a reference leveler. A hardened anvil is attached to the top of the shaft through the plunger, and this surface is indicated by the dial gage. The outer ring fits into the O-ring and moves the dial gage



down—which produces a reading on the scale. The method actually measures the height of the surface above the ring, but is quite accurate.

For reference purposes a setting block is made to the exact dimensions of the depth of the groove, and this is used to set the plus-and-minus indicator to the nonfinal dimension. *H. G. Frommer, Milwaukee, Wis.*

NEWS OF METALWORKING

Currency Devaluation Won't Hurt Machine Tools

WASHINGTON—Foreign currency devaluation may cut U.S. exports of machine tools a little, but not much. In most cases buying plans have been well screened of those items that could be bought from non-dollar sources with reasonable delivery times. Those that remain are integral parts of important development schemes. Many cannot be bought, except from the U.S.

Of course, increased cost to the consumer (due to devaluation of his currency relative to the dollar) will make him try even harder to obtain the item from a soft currency source. And there may be some cases where foreign management will forego the many advantages of U.S. machine tools and metalworking machinery because of increased costs.

Quicker Write-Off of Equipment Studied by Commerce Department

WASHINGTON—Secretary of Commerce Charles Sawyer is working on the problem of liberalizing the depreciation allowances businessmen may claim on plant and equipment. He has already asked the Department's economists to study the effects that stepped-up amortization would have on tax payments and on orders for new machinery.

Program of Business Aids

When this study is complete, it will form the cornerstone of a program of aids to business which Mr. Sawyer will take up to the White House.

Sawyer's current interest in the problem of depreciation grew out of his recent pulse-taking tour of depression areas.

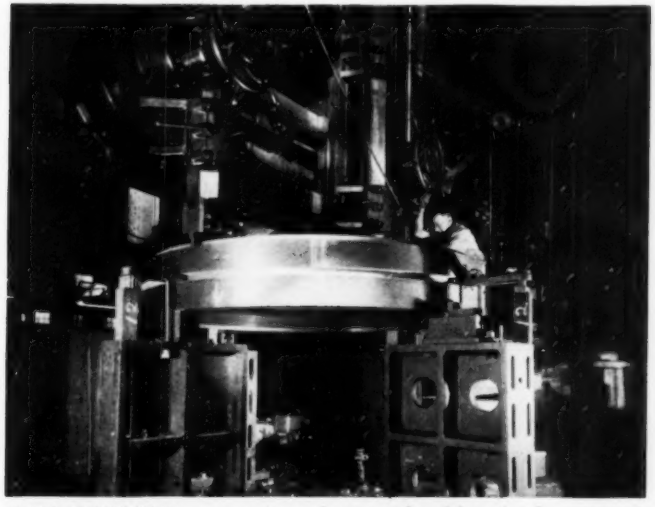
One suggestion was offered over and over again by the executives with whom the Secretary met: Make it more economical for us to buy more efficient equipment — even though the machines we have aren't yet 10 years old.

Machine tool builders stressed the effect that a shortening of the period in which machinery can be written off would have on their particular industry. It wasn't necessary to spell out the impact that this would have on the general level of economic activity in areas with high unemployment—especially New England.

Essentially, businessmen would like to be able to write off machinery in 5 years if they so choose.

Treasury experts have told Sawyer's economists that, if a 5-year depreciation period were adopted, business next year would be saving an estimated $150-$200 million in taxes.

The McGraw-Hill Survey of Business Spending Plans shows that over the next 5 years, American corporations expect to spend $55 billion—with more than half this for equipment alone. Under a 5-year amortization law, this would mean tax savings—in 1955—of about $1- to $1.5 billion. Any substantial part of this sum would assure prosperity for the machine tool industry.



***GIANT COMPRESSOR** rotor section is being machined here for the supersonic tunnel of the National Advisory Committee for Aeronautics, in operation at Langley Aeronautical Laboratory in Virginia. Allis-Chalmers utilized regular manufacturing facilities, like this 16-ft boring mill, in fabricating parts for the specially designed axial compressor which generates a flow up to 870,000 cfm. The need for accurate final balancing of the finished rotor required close machining of discs and shaft ends prior to welding and the prevention of warping during the welding operation*

Here's What Businessmen Want in 'Sawyer Plan'

In addition to liberalizing depreciation allowances, here are some of the other suggestions Secretary Sawyer heard from businessmen; they are likely candidates for inclusion in any "Sawyer Plan" for business:

1. Cut back excise taxes to pre-war levels.
2. Guarantee loans to small business the way Federal Housing now does for home loans.
3. Cut the red tape connected with doing business with Government.
4. Place a larger share of ECA-financed orders with New England firms; ship more through New England ports.
5. Exempt the first $25,000 of corporate income from taxation.

Industry Faces Antitrust Suits

WASHINGTON—New antitrust law is going to be fashioned this fall and winter in federal courts.

Among cases of interest to the machine tool and metal fabricating industry are the cases against Timken Roller Bearing Co., Aluminum Co. of America, American Can Co., three farm machinery makers, and United Shoe Machinery Corp.

Last March the government won a decision in Cleveland in a case charging Timken, and a British and French company with allocating markets throughout the world and fixing prices. Government also asked that the company be prevented from using its "Timken" trademark as a device to restrain competition. The court will seek to determine this month what kind of decrees it will issue to break up the combination.

The United Shoe Machinery Corp. trial resumes this month. Government wants the court to order the company to sell all its plants making shoe factory supplies, and some of its plants making shoe and tanning machinery. Government is also asking that United offer to sell its machinery, instead of only leasing it—and that the court end United's tie-in agreements which require shoe manufacturers to purchase supplies only from United when leasing their equipment.

Coming to trial in Minneapolis around the first of the year will be one of the cases the government has against J. I. Case Co., Deere & Co., and International Harvester Co. The charge: each of the companies has tied up its dealers with exclusive contracts which forbid the dealer from taking on lines of equipment made by competitors.

Tin Can Monopoly Charged

In a trial that ended last March, the Department of Justice charged American Can Co. with monopoly in the production of tin cans and other containers. It asked the court to end the company's tie-in contracts which required a canner, in leasing American Can's can-closing machinery, to agree to buy all his metal and fiber containers from American Can. A decision is expected soon from district court in San Francisco.

The government's 12-year suit to force the Aluminum Co. of America to give up some of its plants starts up again this month in New York. The government says that competitive conditions do not now exist in the aluminum industry. Its argument: Alcoa has a monopoly of the patents in the industry, Kaiser is still dependent on Alcoa for its bauxite—and Alcoa is still the beneficiary of 40 years of monopoly.

***MACHINE TOOLS** of all types and sizes—lathes, boring mills, presses, drills saws and planers—are available to the maintenance machinists of A. E. Staley Mfg. Co., corn and soybean processors, when they start a repair job in the company's Decatur, Ill., plant. The new mechanical shops building also includes electrical, millwright, belt, conveyor, light metals, boiler and repair shops*

New Wage Hour Law Would Boost Pay Of 2½ Million White-Collar Workers

WASHINGTON—Revision of wage-hour regulations proposed by Wage-Hour Administrator William R. McComb, likely to be put into effect shortly after Oct. 10, would:

1. Increase the minimum salary which must be paid 2,500,000 so-called white-collar workers in order to exempt them from overtime pay;
2. Clarify the duties test for determining which white-collar workers are not entitled to overtime pay.

The 1938 Fair Labor Standards Act exempts from the 40¢ minimum wage and 40-hr week these five groups of workers: executive, administrative and professional employees, employees engaged in local retailing and outside salesmen. The wage-hour amendments recently voted by the Senate and House would not change this provision, although the minimum wage for workers covered would be raised to 75¢.

Mr. McComb would raise the salary yardstick for executives from $30 to $55 a week. Minimum salary for administrative and professional employees would be $75 a week instead of the present $200 a month. Unless employees in these types of job were earning these minimum salaries, employers would have to pay them time and a half for overtime. There is no salary test for outside salesmen and employees in local retailing.

New Machines Needed By Management and Labor

PHILADELPHIA—Two misconceptions, one by management and one by labor, are hampering potential productivity, Tell Berna, general manager, National Machine Tool Builders' Assn., told members of the local chapter of the American Society of Tool Engineers at a regional meeting here Sept. 15.

"Too many men in management," Mr. Berna said, "assume that American Industry is marvelously equipped. The fact is that the manufacturing plants of this country are still filled with machine tools of war and pre-war vintage which have long since been obsoleted by post-war models and represent high-cost operation today.

"Added to this is the assumption on the part of some labor leaders that new and better machines throw people out of work. This misconception leads to resistance to the installation of new machines, or to limiting output on the new machine.

1950 Military Procurement Budget Will Near $15 Billion

Money for Aircraft Biggest Item by Far

WASHINGTON—The military budget for fiscal 1950 will run from $14.5 to $15 billion. Congressional budgeteers, in late September, were still haggling over odds and ends, but whatever the final figure, at least half the total will go into procurement, for both durable and nondurable items.

In the adjoining box is given the breakdown of the planned procurement for the next year, a schedule which will be little affected by political money grubbing.

More for Stockpiling

Stockpiling of critical materials (money appropriated in other legislation) will add $565.0 million in cash and $245.0 million in contract authority to the military buying power.

Military pay, allowances, subsistance, clothing and travel will take approximately $6,417.8 millions. Civilian components (Reserve and National Guard) pay, allowances, clothing, procurement and construction will cost an additional $792.5 million. Retired pay costs another $221.8 million.

Total military procurement items and stock-piling approximate $8,271.4 million.

Planned Military Procurement

(in millions)

Aircraft	$2,181.6	War Reserve Material with Long Lead Time	33.1
Ships	56.5	Miscellaneous Hard Goods (Radios, radar, bomb dollies, gas masks, etc.)	236.0
Weapons (Tanks, guns, gun directors)	149.6	Public Works Construction (Continuation of buildings started in previous years)	143.1
Ammunition	128.0	Research and Development	586.6
Guided Missiles	30.8	Maintenance and Operation	3,609.9
Torpedoes	9.1	Industrial Mobilization and Maintenance of War Reserve Plants and Facilities	176.9
Vehicles	107.7		
Railroad Equipment	1.2		
Construction Equipment	8.2		
Heavy Materials Handling Equipment	3.1		

Tool 'Orders' Are Strictly 'Phantom'; Emergency Schedules Not Activated

CLEVELAND—Recent rumors concerning putting "phantom" machine tool orders into production now to aid employment in distressed areas are of unknown origin and completely without foundation, L. D. McDonald, president of the National Machine Tool Builders' Assn. and vice president of The Warner & Swasey Co., Cleveland, told members of the association following a check with the National Security Resources Board, the Dept. of Commerce, and the Munitions Board in Washington.

Activation Would Hurt Industry

"There is no such thing as phantom *orders*," Mr. McDonald said. "There are emergency production schedules which could be activated immediately in case of war. Doing so now would only aggravate the position of the machine tool industry by adding to the stockpile of government-owned machine tools. Furthermore it would have little immediate effect on employment, for it would take manufacturers from six to twelve months to build up to the rate of operations called for by these production schedules.

Better Tax Policy Asked

"A far more constructive step would be the removal of restrictions and obstructions that today discourage the purchase of productive equipment. For example, a liberalization of present tax policies of the Bureau of Internal Revenue with respect to depreciation allowed upon machine tools would, I believe, yield a backlog of orders that would stabilize employment in the industry and enable it to produce at a level guaranteeing the country adequate preparedness for national defense."

***OUT AFTER BUSINESS** goes Lake City Malleable Co., Cleveland, with this specially equipped bus which brings a wide variety of foundry products to the door of the customer. More than 280 model castings are included, ranging from parts for a grave vault to a bomb nose, plus novelty items which still take chrome and silver plating. Experts accompany the bus on its travel, explaining malleable iron to customers and prospects and doing a sales engineering job where necessary*

Gear Manufacturers to Meet

CHICAGO — The American Gear Manufacturers Assn. will hold its semi-annual meeting here at the Edgewater Beach Hotel Oct. 24-26. Featured will be addresses by Dexter Keezer, economist, McGraw-Hill Publishing Co., New York, and Warren Whitney, vice president of James B. Clow & Son and vice president of the National Association of Manufacturers.

ASTE Meeting Will Feature Extensive Technical Program

DETROIT—Details of the program for its 17th semi-annual meeting announced by the American Society of Tool Engineers reveal that it will be featured by one of the most extensive technical programs in the society's history.

Scheduled for the Mount Royal Hotel, Montreal, Oct. 27-29, the three day program provides for nine technical sessions—three on Thursday, five on Friday and one on Saturday.

The majority of the sessions deal primarily with methods by which tool engineers can reduce costs. Cost cutting with tools, cutting costs on dies, cost cutting with machines, estimating and economics of cost cutting are among the major subjects to be tackled at individual sessions.

Opening the program officially on Thursday, Oct. 27, will be a welcoming luncheon at which Camillien Houde, mayor of Montreal, will welcome members to the city. Technical sessions begin at 2:00 P.M.

Technical Papers Listed

Technical papers to be presented at the meetings are: "Mold Die Hobbing," "Mold Die Finishing," "Application of Standard Tool Parts to Cut Costs," "Surface Finish Control and the Making of Master Standards," "Calibration of Master Roughness Standards and Their Use," "Use of Low Melting Point Alloy for Tool and Die Work," "Special Purpose Machines from Standard Units," "Predesign Estimating," "Postdesign Estimating," "Milling Hot Workpieces," "Hot Spot Machining," "Economics of Limited Production," "Tools and Materials for Limited Production," "Quality Control of Limited Production," and "Statistical Quality Control."

Numerous plant visits have been scheduled in the neighborhood of Montreal to permit visiting tool engineers to inspect methods by which Canadian industry has raised itself from eighth to fourth place in industrial output in the world. Plants at which visits have been arranged include Canadian Car and Foundry Co., Ltd.; Canadian Vickers, Ltd., Dominion Engineering Works, Ltd.; Telephone Division and Wire and Cable Division of Northern Electric Company, Ltd.; RCA Victor, Ltd.; Canadair, Ltd.; Canadian Pacific Railway Co., Angus Shops; and Montreal Locomotive Works, Ltd.

Commerce Head Will Talk

Canada's Minister of Trade and Commerce, and also of Supply and Reconstruction, Clarence D. Howe, will be the guest speaker at the semi-annual dinner Saturday evening, speaking on "Industrial Canada—Today and Tomorrow."

An extensive ladies' program has also been developed for the three day meeting including special scenic motion pictures, a motor tour through the Laurentian Mountains, visits to interesting local industries, a fashion show.

A record attendance of Canadian as well as U.S. tool engineers is expected, particularly in view of the fact that Robert B. Douglas, president of the ASTE this year, is a Canadian and president of Godscraft Industries, Ltd., Montreal.

THE METAL SHOW

Exposition hours at the Metal Show in Cleveland's Public Auditorium have been announced as follows: 12 o'clock noon to 10:30 P.M. on Monday, Tuesday, and Wednesday; 10:00 A.M. to 6:00 P.M. on Thursday and Friday.

Turn to Page 113 in this issue for more information about the Metal Show: list of exhibitors, a list of selected technical papers to be presented, and "The Show in Print"—a photographic preview of Metal Show exhibits.

Gas Turbines for Autos To Be Cheaper, Smaller Than Present Reciprocating Engines, ASME Hears

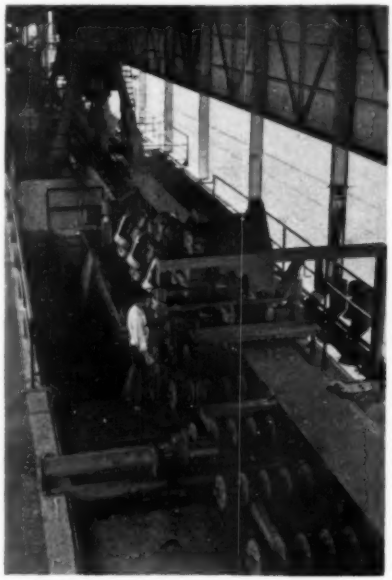
ERIE, Pa.—Gas turbines now on the way for automobiles will be cheaper, smaller and lighter than the present auto engine, Frank L. Schwartz, a University of Michigan professor told The American Society of Mechanical Engineers here Sept. 29. He said other advantages of the automotive gas turbine will be: fewer moving parts, low oil consumption, no need for anti-freeze, smooth operation, elimination of automatic transmissions and ability to use low grade fuels, i.e., fuels that do not require a high degree of refining.

Small Units Have Been Built

Prof. Schwartz addressed the society's fall meeting in the Lawrence Hotel. He revealed that although no announcement has been made of an automotive gas turbine in the United States, several companies have designed and built small gas turbines.

"Gas turbines can effect a 50 percent saving in weight of the engine," said Prof. Schwartz. "A saving in one lb. of engine is accompanied by the saving of another pound in chassis weight so that material saving in weight and cost of a vehicle is realized."

Conceding that there are "many problems to be solved before the gas turbine becomes a practical machine that is competitive with the reciprocating engine for vehicle propulsion," Prof. Schwartz declared, however, that "progress to date on gas turbines does not indicate that these problems cannot receive adequate solutions."



***WELDED STEEL PIPE** output on West Coast will be increased under a joint Kaiser Steel Corp.-Basalt Rock Co. program. New equipment includes a Yoder 1500 - kva resistance welding unit, hydraulic testing equipment, lathing and shearing apparatus, and conveyor facilities. Here in the first forming operation, a 40-ft section of plate enters edge-forming machine (right foreground). Next in line is "U-ing" press, where plate is subjected to top and side pressure to give it a "U" shape. At far end of line is main press*

Job Testing Used In Cutting Costs

WASHINGTON — More employers are using the job aptitude testing service available at local public employment offices as means of cutting costs. This is particularly true of those with costly training programs or high turnover due to inability to get the right persons in the jobs.

One of them is Dravo Corp., Pittsburgh. It had a problem training draftsmen. Only 13 out of 30 trainees lasted the three to four years it took to turn an inexperienced worker into a finished draftsman. The company was spending $2,200 to develop a draftsman.

Tailor-Made Test Presented

At the company's request the Pittsburgh office of the Pennsylvania State Employment Service developed a test, tailor-made, for selecting job-applicants with a potential ability for drafting. The test battery included several paper-and-pencil tests, a peg board measuring hand dexterity, and a rivet-and-washer board measuring finger dexterity.

Since then, the employment office has referred to Dravo those applicants who passed their draftsman trainee aptitude test. Nine sent to the plant so far have all proved satisfactory. The company says they are of much higher quality than the men it had been hiring and they appear to be learning quicker. As a result, the training period may be shortened.

The draftsman test is one of 225 specific aptitude test batteries developed by the U.S. Employment Service in cooperation with local employment offices operated by the states. Tests developed for one employer are made available by USES to all employers in any part of the country.

The tests are available for these jobs in machine shops: Machinist, machinist apprentice, tool-and-die maker, engine-lathe operator, turret-lathe operator, inspector, gear inspector, automatic screw machine operator.

In addition, there are tests covering many metalworking jobs in other industries, such as aircraft manufacturing, ammunition and foundry.

Washing Machine Contract Won

TOLEDO—City Auto Stamping Corp. has obtained a new long-term contract from Nineteen Hundred Corp., St. Joseph, Mich., to manufacture and completely finish tubs and spinner basket assemblies for 1900's line of whirlpool automatic washers and the Kenmore Automatic Washer line, made by the Michigan firm for Sears, Roebuck & Co.

***AUTOMATIC LIFT TRUCK** of 60,000 lb capacity moves draw dies weighing up to 32 tons into or out of large presses in Studebaker's new press dept. Truck has drag chains on each side of 32x60 in. platform for pulling or pushing dies onto or off carrying platform. Diesetter operates pushbutton to control motors driving drag chains. Truck has eliminated need for overhead cranes in the dept., and makes possible changing heavy die sets in about one-third the time normally required when cranes are used. Large fender draw die shown can be removed from press and replaced with another heavy die in about one-half hour truck time. Press is out of production average of 1½ hr for a die change*

Mid-Century Metalworking Inventory Offers New Data on Equipment

NEW YORK—An improved method of presentation has been adopted for the Mid-Century Inventory of Metalworking Equipment, to be published in AMERICAN MACHINIST for November 3. Instead of the large tables measuring nearly three feet in width used in recent years, the data are being assembled in single-page tables.

There will be a page on each industry, each marketing area, and each type of equipment. This will make it much easier to compare data and to find information on a particular subject.

This study, made every five years since 1925 by the editors of AMERICAN MACHINIST, is based upon a sampling of the metalworking industry. The sample is expanded by correlation with census data to arrive at estimates of the amount of each type of equipment in each industry and area. The sample this time is more than twice as large as for any previous study, ranging as high as 83%, which will give the study a more accurate base than in any previous year.

An important addition to the Mid-Century Inventory is the coverage of two groups of equipment not normally considered part of metalworking production. Samples of metalworking equipment in maintenance shops outside the metalworking industry and in college shops will give the first information ever available on the type and condition of a large segment of metalworking equipment.

Powder Metallurgy Symposium

NEW YORK—A symposium on the physics of powder metallurgy was sponsored Aug. 24-26 by the metallurgical laboratories of Sylvania Electric Products, Inc., at Bayside, N.Y. Leading American and European authorities were assembled for the first time under commercial auspices to correlate recent advances in solid-state physics with engineering approaches to problems in powder metallurgy, in order to promote a better understanding of the mechanisms of sintering.

Detroit

STEEL PENSION FIGHT WATCHED . . . 1950 AUTO ORDERS SPUR TOOL AND DIE BUSINESS . . . NASH OFFERS NEW STARTER DEVICE

So far as Detroit interest is concerned, it's been in Pittsburgh. The report of the steel fact-finding panel has provoked more attention and study since its appearance in mid-September than even the continuing high rate of car and truck sales.

There are varying reactions, of course. Generally, Detroit believes that some kind of pension program for most major manufacturing companies will eventually result from the panel report. From that conclusion stems this variety of observations, not necessarily related to each other, but all bearing on the main theme:

1. Pension programs, imposing a continuing new burden on managements, will help keep prices up. Take a case in point: Ford Motor Co. employs about 100,000 hourly paid people. Assume that a pension plan is set up costing the company no more than 5¢ an hour a man—lower than the fact-finding recommendation. That in itself equals $10 million a year, or about $10 per car and truck produced. Put pension burdens on supplier companies, too, and the direct $10 charge is multiplied, perhaps three times.

Old Firms at Disadvantage

2. New companies coming into a business will have competitive advantages over older ones. If pensions are to become the general practice, new companies will start out with young men; their actuarial charges will be lowered.

3. In a related line of thought, older men will find it harder and harder—well nigh impossible—to obtain jobs in a pension-ridden society. No company will take an older man unless it has to, knowing that the inroad he will make on the company-maintained fund will be so much greater than that of a younger man.

4. If a uniform pension payment is developed out of negotiations (which is the one way, of course, that older men would find it so difficult to get jobs with younger applicants at hand) then the competitive burdens on different companies would vary. How will the unions justify that kind of discrimination against companies whose age categories are such that their input into funds must be larger than others?

5. In any case, pensions are an intensely complicated subject—one in which the arguments of collective bargaining will vastly compound the problems. The experts are looking forward to headaches, plenty of them.

Pickup in Tool and Die Shops

So much for labor problems. Looking at labor payrolls, the one recent development of note has been a modest pickup in the tool and die shops of this area. Employment has advanced from 5% to 10% or so at many shops since early August, marking what all hope is a definite turn away from the slow slippage of the past few years. The reason: Automotive orders for 1950 models, none of them significant, all of them helpful, together with a quiet inflow of outside work.

1950 Nash Introduced

Nash has followed Studebaker in showing 1950 models; the changes are not notable outside, but numerous mechanical developments are reported. The most important is the use of the Hydra-Matic transmission of General Motors, available as an option on the senior, Ambassador line.

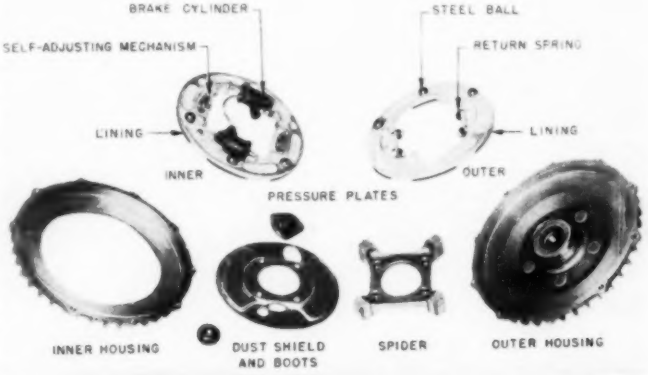
Nash has an interesting new wrinkle of its own with the Hydra-Matic. The gear selector lever is simply lifted up to start the engine; the old time foot pedal or button starter has disappeared. Many other companies are working on similar automatic starter mechanisms; most of these are based on the premise that the easiest way is to use the turning of the engine key to put the starter motor into operation.

Nash has gone with the trend in raising compression ratio, which now stands at 7.3-to-1, up 0.3 from last year, on the 8-cylinder job. This powerplant turns up 115 hp, and uses regular gasoline.

Output and sales have bulled their way into new high ground during recent months. August saw the industry reach an all-time high mark which may stand for some time—656,713 cars and trucks. The September total, running at a parallel high daily plane, will be lower than August's due to the availability of fewer working days, but nevertheless volume is holding close to 150,000 assemblies a week, which is boom business from any standpoint. Barring strikes which take their toll in vehicle production, October will see the rate maintained fairly uniformly, but thereafter will come let-up—some manufacturers will change over to new models, and all will taper off, but not too much.

60 Olds Engines per Hour

At Lansing Olds preened its feathers in mid-September, and on the occasion of the first anniversary of its high-compression "Kettering" engine, delivered itself of numerous statistics. Most notable: Production today is at about 60 units an hour on the new engines, with two full shifts operating. Spotting of machines in the new plant to broaden bottlenecks will bring that total to 68 an hour by the end of the year.



***CHRYSLER'S SELF-ENERGIZING DISC BRAKE** permits better cooling and easier operation, the company says. Here are shown the component parts, left front brake. Not only is brake self-energizing but self-adjusting as long as cemented brake linings last. The cast iron halves of the brake drum introduce new technique in brake production problems. Most brake drums are either stampings or composite*

Names in the News

Joseph B. Clough

Joseph B. Clough has been named vice president of Godfrey Tool & Supply, Inc., Cleveland. Since June 1948 he has been assistant to the president of the A. W. Hecker Co., Cleveland, and previously was vice president and sales manager of Johnston & Jennings Co.

George E. Dresser, manager of hardware-automotive sales for The Carborundum Co., Niagara Falls, N. Y., since 1920, has retired after 42 years on the company's sales force. He is being succeeded by **Charles W. Sprenger,** who was manager of Carborundum's New York office from 1944, until he was appointed assistant manager of hardware-automotive sales in 1947. **L. P. Mercer,** formerly manager of the company's sales training dept., has been named assistant manager of hardware-automotive sales.

R. A. J. Wellington

R. A. J. Wellington has been named national sales manager of Precision Metalsmiths, Inc., Cleveland. He has been in charge of Precision's home-office sales since 1946. During the war he was manager of the Cleveland branch of the Office of Production Management.

H. E. Chilcoat has been named manager of the newly created railroad sales dept. for the Townsend Co., New Brighton, Pa. He was formerly vice president in charge of sales for the Pressed Steel Car Co., Pittsburgh, and before that was with Westinghouse Air Brake Co. and the Clark Car Co.

Frederick A. Fielder has been named general manager of the Bar-Way Co., Stamford, Conn. He has been chief engineer of the National Mfg. Corp., New York. Previously he was an engineer with the Narragansett Machine Co., Providence, and was chief engineer of Doehler Metal Products Co., New York.

John G. Benjamin

John G. Benjamin has been appointed sales manager of Abbott Ball Co., Hartford, Conn., succeeding **J. M. Taylor,** resigned. Mr. Benjamin will be in charge of sales for both the bearing ball and burnishing divisions.

Frank J. Aschenbrenner and **Earl C. Clark** have been named assistant directors of research and engineering, Air Reduction Sales Co., New York. Mr. Aschenbrenner will head the Murray Hill, N. J., laboratory. Mr. Clark will head the development and engineering groups. **J. K. Hamilton** has been named manager of apparatus research division, with **H. O. Klinke** as assistant manager. **J. T. McKnight** was named supt. of production and services section, and **T. J. Cholis** supervisor of patent section. **J. B. Davenport,** formerly assistant manager of the Detroit district, has been appointed assistant manager of the Charlotte district. **J. H. Hart,** formerly assistant sales manager at Detroit has been named assistant manager of the district. **R. A. Jamieson** succeeds Mr. Hart in Detroit. **A. S. Blodget, Jr.,** has been named assistant manager of the Boston district.

Griffith C. Taaffe

Griffith C. Taaffe, sales manager of Cincinnati Lathe & Tool Co., Oakley, a subsidiary of Cincinnati Milling Machine Co., has been elected a vice president of the lathe company. He became associated with Cincinnati Milling in 1935, and previously had spent some six years with the Cincinnati and Buffalo plants of Worthington Pump & Machinery Corp. in various capacities. During the war he acted as technical advisor to the tools branch of the War Production Board, Washington, D. C., and subsequently established and operated the Washington office of Cincinnati Milling & Grinding Machines, Inc.

George Perrault, Jr., has been appointed sales manager of the rolling mill division of E. W. Bliss Co. at Salem, Ohio.

R. E. Burroughs has been appointed manager of engineering of General Electric's aircraft gas turbine division, at Schenectady. **H. D. Kelsey,** formerly manager of engineering of the division, has been appointed administrative assistant to the manager of the turbine divisions.

George A. Pockels

George A. Pockels has been named director of European operations, Clearing Machine Corp., Chicago. With his headquarters in Paris, he will supervise service to European owners of Clearing presses.

Brig. Gen. Elbert L. Ford

Named Chief of Ordnance, as noted in A.M. Sept. 22, page 137.

John A. Lauck has been named vice president of the Pesco Products Division of Borg-Warner Corp., Chicago. Mr. Lauck, who has been chief engineer of Pesco's pump division for the last four years, will assume his new post immediately, several months before the scheduled start of operations in the company's new $2,650,000 plant. Other appointments: **D. A. Sutherland,** formerly Pesco's eastern sales manager for industrial products, as industrial relations manager; **G. V. Patrick,** formerly executive vice president of the Cleveland Automatic Machine Co., to succeed Mr. Sutherland in his previous sales managerial position; **Frank R. Canney,** sales engineer in charge of Pesco's sales activities with the airline companies.

Sam White, chief engineer of American Mfg. Co., Montgomery, Ala., has been made general manager. He retains his title of chief engineer.

David M. Hallier, who recently resigned as vice president of the National Tool Co., Cleveland, has established a cutting tool specialty house in Elyria, Ohio.

Martin J. Verhuel has been named chief product engineer, Meat Saw Division, Wells Mfg. Corp., Three Rivers, Mich. **Erwin Tobler** has been named chief product engineer, Metal Saw Division, and **David T. Evans** has been named research engineer for both divisions. **W. F. Wells,** formerly vice president in charge of engineering, has left the company.

Business Items

Elliott Co., Jeannette, Pa., has acquired the business and assets of Crocker-Wheeler Electric Mfg. Co., to be operated as a division of Elliott.

Russell Mfg. Co., Middletown, Conn., plans the opening of a branch plant in Bennettsville, S.C., about the first of the year. If plans materialize, a 54,000 sq ft building will be built there to be operated by a subsidiary, Russell Products Co., on a long-term lease with option to purchase. The plant will produce certain types of narrow fabrics.

Dayton Reliable Tool & Mfg. Co., Dayton, Ohio, has started operations in its new plant. The new firm, which absorbed the assets of several smaller companies, is engaged in tool making. Victor Waltz has been named general manager of the firm, which has employed 25 people initially.

Butterfield Division of Union Twist Drill Co., Derby Line, Vt., has appointed Bond Supply Co., as distributor in Kalamazoo and Battle Creek, Mich.

Texas Engineering & Mfg. Co., Inc., Dallas, has been awarded an initial contract for the fabrication of 22 structural brackets for the Chase Avitruk, by Chase Aircraft Corp., Trenton, N.J. The brackets are of a type for which forgings normally would be used, and will be milled by Temco from 24 ST bar stock 11½ in. wide, 12 in. long and 2 in. thick.

Chicago Pneumatic Tool Co., New York, is nearing completion of its new plant in Utica, N.Y. The main building is over one-fifth mile long and nearly half as wide. Freedom of space and layout enabled plant men to devise a "similar-process" system of flow control which, the company says, rivals the motor car assembly line in efficiency. Separated from the main structure are buildings for the forge shop, plating shop, power plant, and foundry. Both sections of the plant are serviced by a Chip-Veyor system for automatically handling and processing metal chips and coolant.

Obituaries

James W. Chalmers, for 25 years with the Wm. K. Stamets Co., Pittsburgh, as a sales engineer, died Sept. 1. He was a member of the American Society of Tool Engineers and served on the War Production Board in Washington during the war.

Fred H. Albrecht

Died Aug. 27, as noted in A.M., Sept. 22, page 138. He was formerly with Lodge & Shipley Co., Cincinnati.

William D. Wendle, 54, credit manager, Stamford division, Yale & Towne Mfg. Co., Stamford, Conn., died Sept. 6. He joined the company in 1915 as an assistant in the accounting dept.

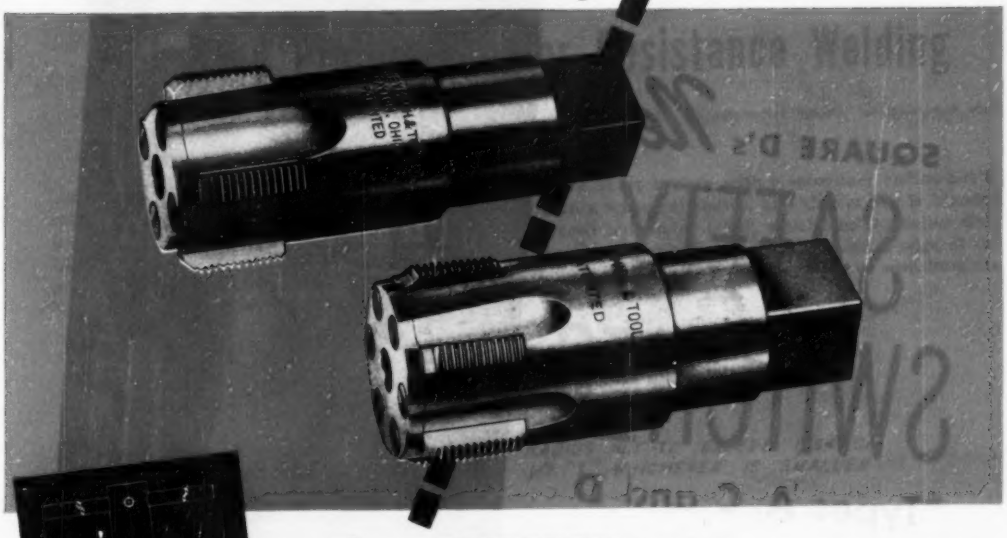
Arthur E. Ulrich, general sales manager of Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., died suddenly while on business in Toledo on Sept. 8. Born in Switzerland, he got his schooling in that country and in Germany and was a graduate of the Technical University at Mitwaida, Germany. He came to the United States in 1913 and became an American citizen in 1928. He was associated with H. B. Kraut, former board chairman of Giddings & Lewis, in Joseph T. Ryerson & Son of Chicago, when Mr. Kraut was manager of the machinery division. He was in Ryerson's machinery export division from 1916 to 1922. He then was successively chief engineer of the Ferguson Furnace Co. and chief engineer of the Colorizing Co. In 1925 he again joined Mr. Kraut at Giddings & Lewis. Up until July of this year he had been district sales manager for the past 21 years in Detroit and the middle eastern states.

HERBERT C. ELLSWORTH, 68, president of White Tool & Supply Co., Cleveland, until 1945, died September 7.

Donald C. Bakewell, 61, sales vice president of Blaw-Knox Co., Pittsburgh, died Sept. 10. He had been with the company since 1937. He was a director and member of the executive committee of Blaw-Knox, and was also a director of Illinois Zinc Co., president and a director of Pittsburgh Forge Iron Co., and a director of E. H. Jennings Bros. Co.

Arthur E. Ulrich

IF YOU HAVE A LOT OF THREADING,



Taps "EHB" and "RHB" (4 and 6 chasers) models are standard in sizes from 1¼" to 6". Special taps of this kind can be made entirely to your specifications. Bottoming taps are available by use of overhanging chasers.

these MURCHEY taps will *Save you money*

Contrast these Murchy Adjustable Taps with the conventional, solid tap on a straight unit cost basis (cost per inch of threaded hole). Every tap, after a certain amount of use, has to be re-ground. You can regrind the chasers of these taps and still retain exact size because of their adjustable feature. In fact, you can keep on regrinding the chasers both on the chamfer and the face and adjusting them radially outward until there are practically no cutting teeth left. And then, merely with a new set of chasers, you can start the whole cycle over again. A set of chasers costs a lot less than a new, solid tap.

Another saving is that a single tap body may be used for a wide range of sizes and pitches with the appropriate chasers.

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Since 1904
Lower cost per thread...
WITH MURCHEY TOOLS

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SUBSIDIARY OF THE SHEFFIELD CORP.

Manufacturers of collapsible taps, self-opening die heads (tangent and radial chaser types) and special threading tools

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SAFETY SWITCHES

*Types A, C and D

Backed by 40 years' DESIGN LEADERSHIP

The remarkable superiority of this new switch line is reflected in these TYPE A design and operating features:

MODERN STYLING is both functional and attractive.

COMPACTNESS obtained without sacrifice of wiring convenience.

FULL COVER INTERLOCK has attachment that locks switch "ON" or "OFF" with 1, 2, 3 or 4 padlocks of nearly any size or shape.

SIMPLE MECHANISM—quick make-and-break action—no dead center.

SILVER-PLATED current-carrying parts.

EXPOSED BLADES permit visual checks of switch operation.

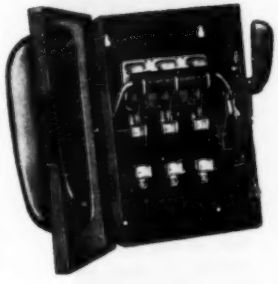
DEAD-FRONT line terminals are protected by hinged arc chamber cover.

MAGNETIC ARC PLATE adds to unusually high rupturing capacity.

POSITIVE PRESSURE jaws and fuse clips, steel reinforced, silver-plated.

NON-TRACKING insulation used in base. Melamine insulating cross-bar.

REMOVABLE PRESSURE CONNECTORS permit substitution of solder lugs, where preferred.



*Types **C** and **D** *similar to Type* **A** *in appearance—differ in construction details*

In production: 30 and 60 ampere sizes ...**NOW** · 100 and 200 ampere sizes ...**SOON** · Larger ampere sizes ...**LATER**

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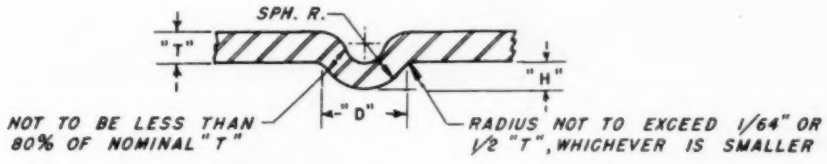
American Machinist

Embossed Projections for Resistance Welding

These data are used by the automotive industry for low-carbon steel

Successful projection welding depends on the selection of the proper contour and size of embossed projections on one of the two sheets to be joined. Limits for the height *H* and the diameter *D* of the projection are given for U. S. standard gages from Nos. 3 to 30, inclusive. Projections are assumed to have a spherical radius, and this radius is blended to the sheet surface with a secondary radius not to exceed 1/64 in. or 1/2 *T*, whichever is smaller. Said secondary radius is simply the rounded edge of the hole of diameter *D* in the die as can be seen from the illustration.



Material Thickness		Projection Height H		Projection Dia. D		Shear Strength
Inches	U. S. Gage	Max	Min	Max	Min	Per Weld, Lb.
0.239	3	0.075	0.070	0.280	0.270	8250
0.224	4	0.075	0.070	0.280	0.270	
0.209	5	0.070	0.065	0.260	0.250	
0.194	6	0.070	0.065	0.260	0.250	7100
0.179	7	0.065	0.060	0.240	0.230	5900
0.164	8	0.065	0.060	0.240	0.230	
0.150	9	0.060	0.055	0.220	0.210	4750
0.135	10	0.060	0.055	0.220	0.210	
0.125	1/8"	0.055	0.050	0.200	0.190	
0.120	11	0.055	0.050	0.200	0.190	3600
0.105	12	0.055	0.050	0.200	0.190	
0.090	13	0.050	0.045	0.180	0.170	2400
0.075	14	0.050	0.045	0.180	0.170	
0.067	15	0.045	0.040	0.160	0.150	1675
0.060	16	0.045	0.040	0.160	0.150	
0.054	17	0.040	0.035	0.140	0.135	1175
0.048	18	0.040	0.035	0.140	0.135	
0.042	19	0.035	0.030	0.125	0.120	765
0.036	20	0.035	0.030	0.125	0.120	
0.033	21	0.030	0.025	0.110	0.105	
0.030	22	0.030	0.025	0.110	0.105	525
0.027	23	0.030	0.025	0.110	0.105	
0.024	24	0.025	0.020	0.095	0.090	
0.021	25	0.025	0.020	0.095	0.090	325
0.018	26	0.025	0.020	0.095	0.090	
0.016	27	0.020	0.015	0.080	0.075	
0.015	28	0.020	0.015	0.080	0.075	215
0.014	29	0.020	0.015	0.080	0.075	
0.012	30	0.020	0.015	0.080	0.075	

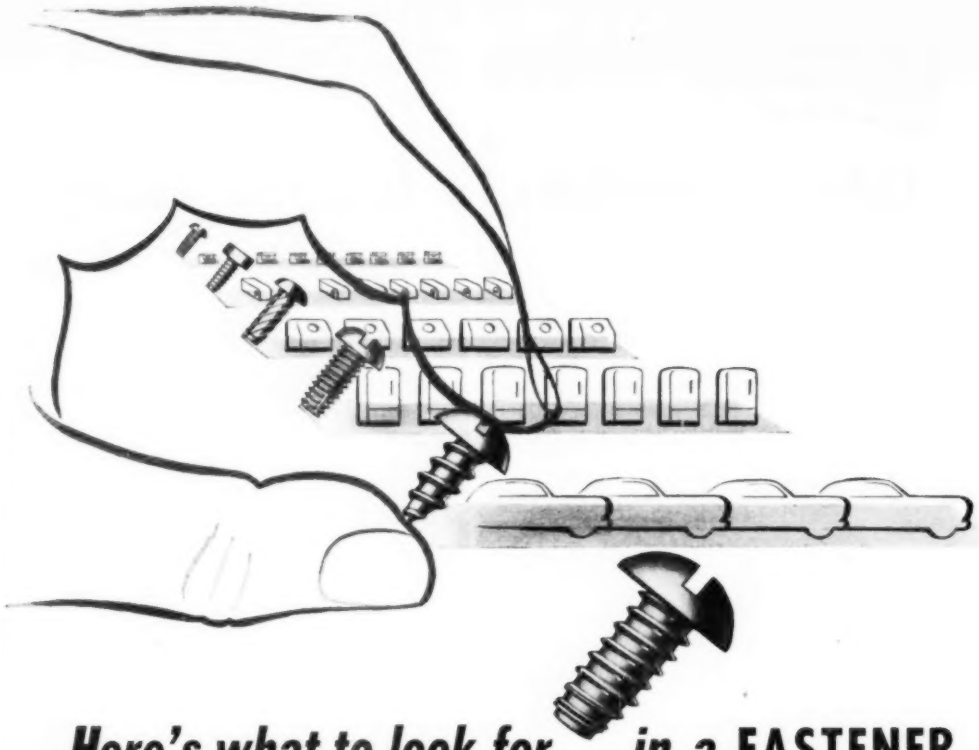
Notes:

Follow these rules to obtain the tabulated shear strengths of projection welds, best electrode life and desirable metal-finishing conditions on thinner material:

1. When two different thicknesses of material are to be joined, and the projection is embossed on the thinner piece, choose *H* and *D* according to the material embossed. *Example:* 0.125-stock joined to 0.036-in. material—for the latter sheet thickness, $H = 0.035$ and $D = 0.125$, according to rule 1.

2. When the projection is embossed on the heavier sheet, select *H* according to the thinner piece and *D* according to the material to be embossed.

Example: 0.125-in. material joined to 0.036-in. stock—the value of *H* for the thinner sheet is 0.035 in., and the value of *D* (thicker sheet) is 0.200 in.



Here's what to look for in a FASTENER

to cut your assembly costs

Ask yourself, first, can you *use* a Self-tapping Screw? Many thousands of manufacturers are saving as much as 50% in assembly work-hours today with this simpler, speedier fastening method. Tapping, riveting, nut-running, inserts in plastics—work-slowing operations which add needlessly to production costs—are completely eliminated.

Then, consider the maker. For the *real* economy of Self-tapping Screws is in their *application*. Parker-Kalon, *originators* of this type of fastener, and *specialists* in its manufacture, alone can offer the wealth of information 35 years of experience represents.

What's more, with a complete line of Self-tapping Screws for every metal and plastic assembly, the advice of a Parker-Kalon Assembly Engineer is unbiased. Parker-Kalon, in brief, *fits the screw to the job*. That's why, 7 out of 10 times, manufacturers can look for substantial savings in assembly costs with P-K Screws.

CALL IN A P-K ASSEMBLY ENGINEER. Very likely he can help simplify your assemblies, save time and cut production costs with the simpler, operation-saving Parker-Kalon fastening method. If you prefer, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick St., New York 14, N.Y.

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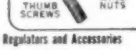
P-K®

The Original

PARKER-KALON SELF-TAPPING SCREWS

FOR EVERY METAL AND PLASTIC ASSEMBLY

P-K Also Makes *Cold-forged*



OTHER P-K PRODUCTS: Cold Forged Socket Screws, Wing Nuts, Thumb Screws • Hardened Screwnails and Masonry Nails • Shur Grip File and Solder Iron Handles • Metal Punches • Bumper Regulators and Accessories

American Machinist

Protective Treatments for Aluminum...I

BY JEROME L. BLEIWEIS, METAL FINISHING CONSULTANT

Alrok Process

Purpose—To produce a coating on aluminum and its alloys which will provide corrosion resistance and will serve as a paint base.

Nature of Coatings—The Alrok coatings are comprised of aluminum oxide. The coatings may vary in color and appearance, depending on the alloy being treated. Coatings may be white or gray, green, yellow green, brownish, olive drab. The colors are due to inclusions of chromium salts in the coating.

Treatment Procedure:

1. Clean the parts to be treated by vapor degreasing or mild alkaline cleaning.
2. Rinse in cold water.
3. Immerse parts for a short time in strong nitric or sulfuric acid at room temperature.
4. Rinse thoroughly in cold water.
5. Immerse the parts for 20 min in either of the following solutions maintained at about 190 F:
   (a) For wrought parts:
   2% sodium carbonate, Na_2CO_3
   0.1% potassium dichromate, $K_2Cr_2O_7$
   (b) For cast parts:
   3% sodium carbonate
   0.1% potassium dichromate
6. Rinse in cold water.
7. Seal the work by immersing in a 5% potassium dichromate solution maintained at 180 to 190 F for 10 min.
8. Finally, rinse thoroughly in cold water and then in hot water to facilitate drying.

Notes and Comments:

1. Alrok coatings are not as thick or abrasion resistant nor do they give the protection afforded by the best Alumilite (sulfuric-acid anodized) coatings.
2. They possess an important advantage over anodizing, in that an electric generator is not required for their production and, in general, equipment and production costs are lower.
3. Dimensional changes on machined surfaces are slight and do not vary appreciably, regardless of alloy or treatment.
4. The Alrok process can be employed to increase the emissivity or heat-radiating power of the aluminum surface.
5. The proper ratio of alkali to dichromate is important in the operation of the Alrok process. For wrought products the recommended ratio of carbonate to dichromate is 20:1; for castings, the recommended ratio is 30:1.
6. Generally speaking, increasing the chromate content reduces the rate of coating formation, and increasing the sodium carbonate content increases the reactivity of the solution. If the carbonate content is too high the solution will produce soft, smudgy coatings. If the chromate is too high, very little coating will be found.
7. The Alrok process was developed by and is licensed to users by the Aluminum Company of America.

Alumilite Process

Purpose—To provide a coating (by sulfuric-acid anodizing) on aluminum and aluminum alloys which shall be corrosion resistant and which shall be suitable as a base for paint or dye.

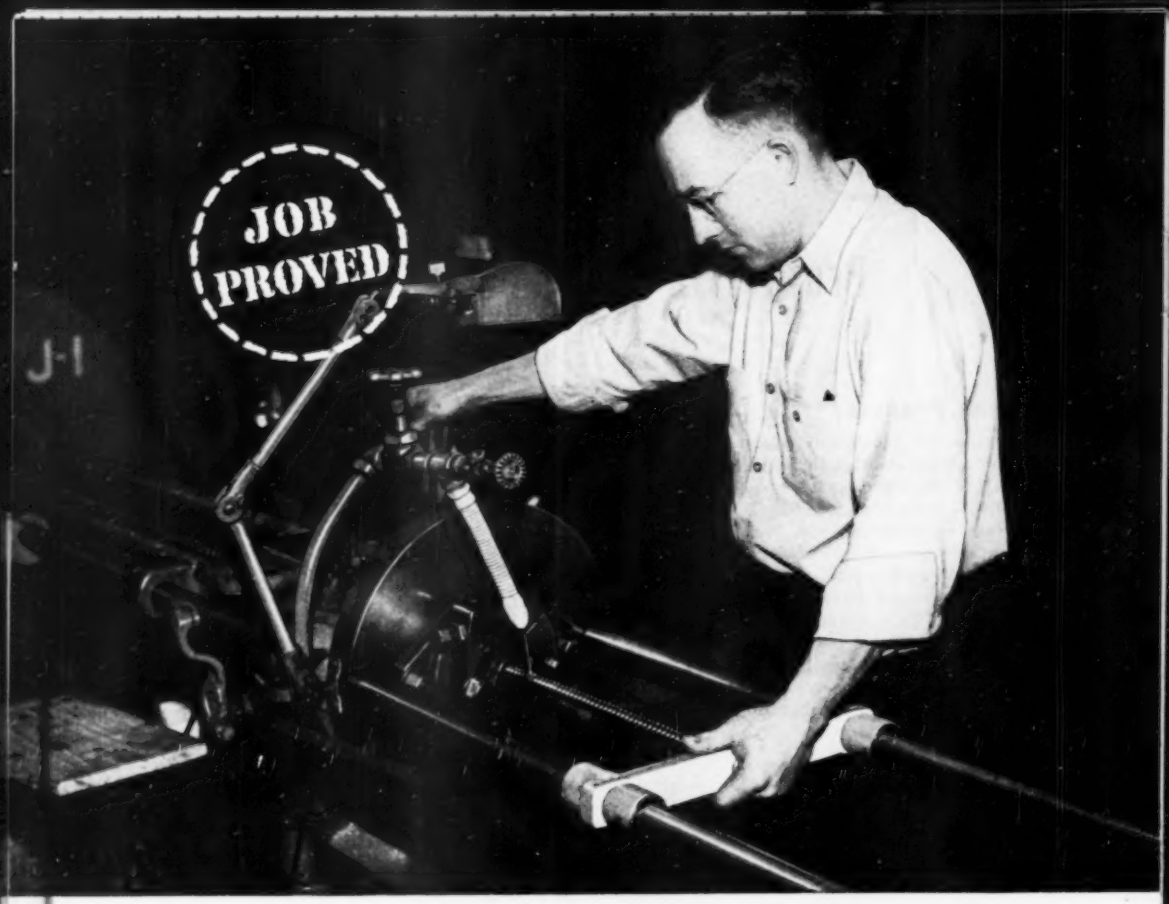
Nature of Coating—The coating produced consists primarily of aluminum oxide Al_2O_3. After sealing, the coating may consist of aluminum oxide, aluminum hydroxide or hydrated aluminum oxide plus chromium salts in both the reduced and oxidized state if dichromate sealing solutions are used.

Treatment Procedure:

1. Clean the work by vapor degreasing or mild alkaline cleaning.
2. Suspend the work from the positive pole of an electrical circuit (anode) into a solution of sulfuric acid in water, and allow electrolysis to proceed for 30 min.
3. Rinse in cold water and follow by a hot-water rinse to facilitate drying.
4. If the coating requires sealing, immerse the work in boiling water or in a boiling 5% potassium-dichromate solution for 30 min. and then rinse in hot water and dry.

Notes and Comments:

1. This process produces coatings which give excellent protection against corrosion and which serve as excellent bases for paints, oils, waxes, and dyes. Properly applied coatings will withstand 700 hr in a standard salt spray or 250 hr if the parts are flat and inclined 6° with the vertical, without showing signs of corrosion.
2. The Alumilite process can be used on all aluminum alloys regardless of copper content.
3. Concentration of the sulfuric-acid solution may vary considerably, depending upon the various coating properties and operation desired, but solutions containing 15 to 18% of sulfuric acid by weight are generally suitable.
4. The potential used in the Alumilite process may vary between about 10 and 22 volts, depending upon the alloy being



TOOL LIFE INCREASED 25%

Sunicut Improves Broaching Finishes, Operators Like Its Transparency

A plant manufacturing valves was using an expensive straight animal oil for broaching. They were also adding large amounts of this product to the cutting oil used in most other machining jobs. Naturally, cutting oil costs were high.

On the advice of a Sun Engineer who had been called in, the company tried Sunicut. Good finishes resulted in all operations, completely eliminating the need for straight animal oil. Tool life increased 25 percent. Operators liked Sunicut for its transparency—it kept work visible all the time. The plant has been using Sunicut for 14 years with complete satisfaction. Two years ago, the company switched to Sunicut with Petrofac, and since then results have been even better.

Wherever operations involve tough cutting, tapping, or threading, the new grades of "Job Proved" Sunicut with Petrofac will give smooth, accurate finishes. The new grades of Sunicut possess superior metal-wetting, antiweld, and extreme pressure characteristics. They do not contain any animal or vegetable fatty oils—therefore cannot turn rancid.

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American Machinist

Protective Treatments for Aluminum...II

anodized. The current density employed is generally about 12 amp. per sq. ft.

5. Temperature of the sulfuric-acid bath is maintained at about 70 F.

6. The Alumilite coating may be almost as thick or as thin as desired, depending upon the concentration of solution used, temperature, current density and other conditions of operation. Generally, however, the coating thickness ranges between 0.0001 and 0.0004 in.

7. Dimensional changes of parts made from die castings, permanent mold castings, or wrought material may range from +0.0001 in. to −0.0003 in. on a side. Dimensional changes of parts made from sand castings may range from +0.0002 in. to −0.0003 in. on a side.

8. Coatings produced by the Alumilite process are generally harder, thicker, and more abrasion resistant than those produced by the chromic-acid anodizing process.

9. Parts that have been anodized by the sulfuric-acid process may be more readily dyed black than those anodized by the chromic-acid process. The parts, after Alumiliting, are immersed in a black-dye solution, consisting of negrosine, metinal yellow and water, for a period of 10 min., after which they are washed in fresh water. They are then immersed in a boiling 5% potassium dichromate solution for 30 min. in order to seal the black coating. The parts are finally washed in cold water and then in hot water to facilitate drying.

10. The sulfuric-acid anodizing process is approved by the Army and Navy as a finish for aluminum and its alloys.

11. The Alumilite process is available to users by licensing arrangement with the Aluminum Company of America.

Anodizing (Chromic Acid)

Purpose—To provide a coating on aluminum and aluminum alloys, which shall be corrosion resistant, and which shall be suitable as a base for paint.

Nature of Coating—The coating produced consists primarily of aluminum oxide, Al_2O_3, plus occluded chromium salts in both the reduced and oxidized state. The thickness of the coating may range from 0.00003 to 0.0002 in.

Treatment Procedure:

1. Clean the work by degreasing or by alkaline cleaning.

2. Suspend the parts from the positive pole of an electrical circuit (anode) in a 2-10%, and preferably 5.8 to 9.0%, by weight solution of chromic acid. Allow electrolysis to proceed for 1 hr.

3. After treatment, rinse the parts in cold water and follow with a hot-water rinse to facilitate drying.

4. If the coating is to be sealed, immerse the parts in boiling water or in a boiling 5% potassium-dichromate solution for 30 min. and again rinse and dry.

Notes and Comments:

1. This process produces coatings which give excellent protection against corrosion, and which serve as excellent bases for paint. Properly applied coatings will withstand 700 hr. in a standard salt spray or 250 hr. if the parts are flat and inclined 6° to the vertical, without showing signs of corrosion.

2. The chromic-acid anodizing process should not be used on aluminum alloys containing more than 5% copper.

3. The temperature of the chromic-acid solution is maintained at 78 F for cast material and at 102 F for wrought material during operation of the process.

4. All cast surfaces are treated at 30 volts for a minimum period of 1 hr and all wrought surfaces at 45 volts for 1 hr.

5. Dimensional changes of parts made from die castings, permanent mold castings or wrought material may range from −0.0000 to +0.0001 in. on a side. Dimensional changes of parts made from sand castings may range from −0.0000 to +0.0002 in. on a side.

6. Coatings produced by the chromic-acid process are generally softer, thinner and less abrasion resistant than coatings produced by the sulfuric-acid anodizing process.

7. Brown chromic-acid stains left on the work due to insufficient washing are not objectionable from the point of view of corrosion. This is an advantage over the sulfuric-acid process in that no fear exists that residual acid will corrode the aluminum.

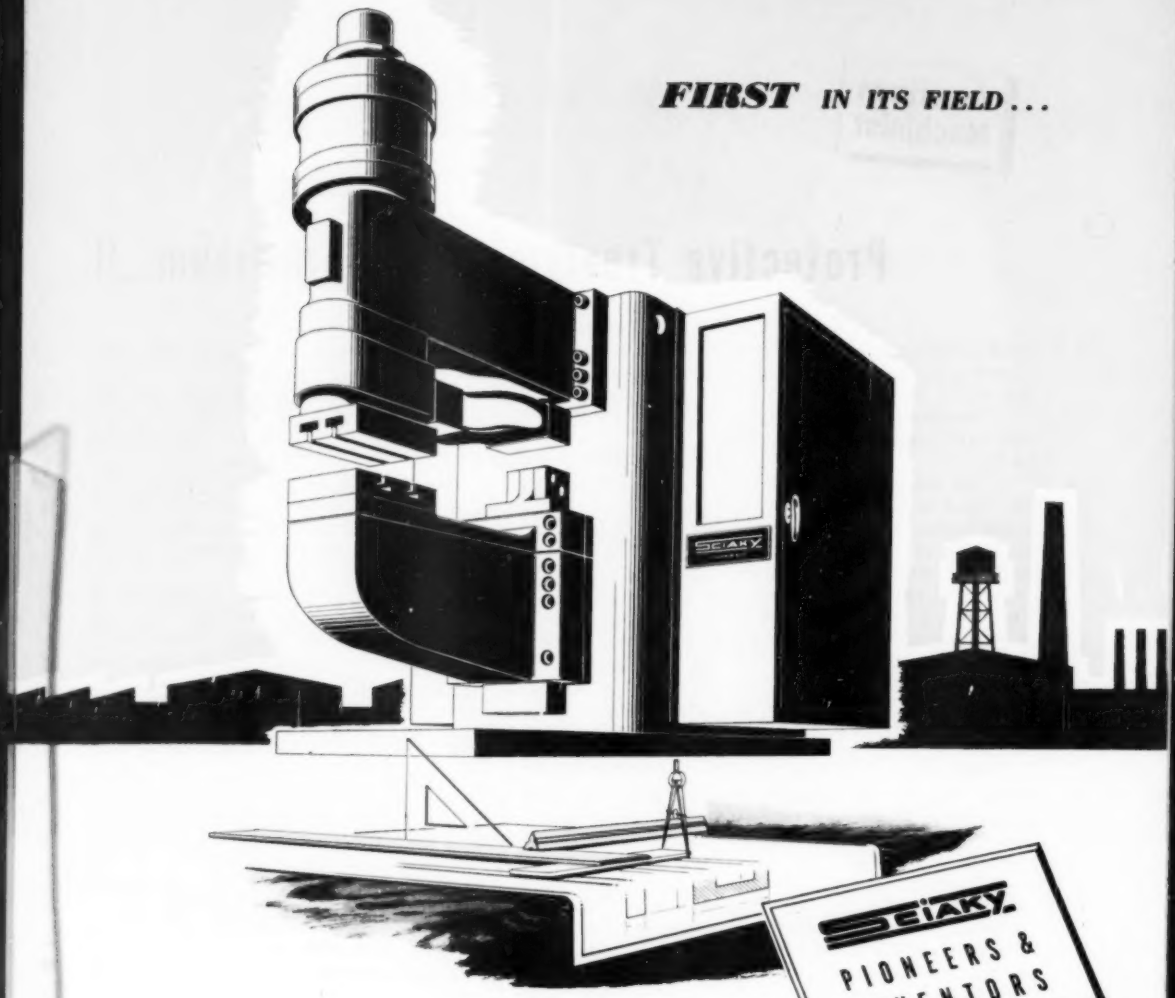
8. The chromic-acid anodizing process is approved by the Army and Navy as a finish for aluminum and its alloys.

9. The coating may be dyed but not with the same facility as with coatings produced by the sulfuric-acid anodizing process.

10. The chromic-acid anodizing process was developed by G. D. Bengough and J. M. Stuart. It is freely available and unhampered by licensing arrangements.

11. In common with other anodic films on aluminum, the coating is electrically resistant and interferes with some uses.

FIRST *IN ITS FIELD . . .*



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PIONEERS & INVENTORS

First in the application of precision weld timers.

First in the widespread manufacture of pneumatically operated welding machines.

First in the development of spot welding of scaly and heavy gauge structural steel.

First in the use of the electro-magnetic storage of energy principle for welding non-ferrous alloys, today representing over 85% of welding machines in use in the Aircraft Industries.

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THREE-PHASE
The revolutionary development in the science of electric resistance welding

SCIAKY BROS., INC. • 4915 W. 67th STREET • CHICAGO 38, ILLINOIS

TALKING SHOP

71 Years With Labor

LABOR RELATIONS were a problem 71 years ago. *A.M.* for February, 1878, reported shop rules in a large locomotive plant thusly: "The hours of labor shall constitute a day's work from 7 AM to 12 M and from 12:30 to 6 PM. On Saturday, work shall cease at 3 PM." A New England machine shop reported that, as a result of 20 years of experience, "Unnecessary conversation, reading, whistling, smoking or frolicking are strictly prohibited in the works." Another firm reported, "Throwing things in the shop, at any time, is strictly forbidden . . ." Our first article on apprentice training appeared, incidentally, in November, 1877.

$200,000 for Ideas

MORE THAN 4,000 EMPLOYES of Ford have earned $200,000 for suggestions in the past two years. Some awards have been $1,500, the average $48.05. The system was started in Lincoln-Mercury and the steel plant in August, 1947, now covers 61 units, will be company-wide by the year-end. Of 23,810 suggestions submitted, 5,974 have been adopted and 4,049 awards made. The others await determination of the amount to be paid. Thus far, the average award is $28.67 above the national average.

Brains Nucleus

LAWRENCE INSTITUTE OF TECHNOLOGY, Detroit, has started an ingenious scheme whereby a cooperative group is set up among men having outstanding scientific and inventive abilities. The group is thus provided with an attractive atmosphere, as well as the incentive to act as consultants, inventors, writers, etc. The plan is expected to be self-supporting at least, while providing exceptional encouragement to talent.

Daffynitions

BAR: where you go in optimistically, and come out misty optically . . . DIPLOMACY: the art of throat cutting without a knife . . . PROSPERITY: what most people can't stand—and what most people don't have to . . . FACE: what you save by keeping the lower end closed . . . MARIGOLD: what a chorus girl hopes to do . . . CLOCK-EYED WORLD: what commuters live in . . . BRIDGE PARTY: who, what, when and wear . . . BRIDGE TABLE: where a wife does her husband's bidding . . . SILENCE: college yell for the school of experience . . . RETIRING DENTIST: one who quits the daily grind . . . STYLES: they change frequently, while women's designs stay the same . . . CAFETERIA: where they take the rest out of restaurant and put the din in dinner.

Inside Dope

TO IMPROVE VISIBILITY on the inside surfaces of machine tools, one British builder now paints them with a bright yellow oilproof paint. The light color makes it easier for assemblers and maintenance men to work in a shaper crank housing, for example, and is better than the white paint formerly used as it does not look dirty when splashed with oil or handled by oily hands. All internal parts except finished working surfaces are similarly painted.

Automatic Diamonds

ONE BRITISH MACHINE-TOOL BUILDER developed a special machine for polishing gem diamonds. It proved so successful the company is now one of the biggest cutters. Work is done by disabled veterans who can be trained to become expert polishers in three months. Stones are held in a specially designed chuck which has only 0.0002-in. grip but exerts 120,000-psi pressure. Chuck parts are all lapped fits, fully interchangeable in special indexing heads so accurately made that every facet produced is geometrically perfect. This is believed to be the only plant in which stones are precision cut and polished by machine. Stones so polished have a much better "fire" than handcut stones, which often lose much of their beauty through minor inaccuracies in the dividing of the facets.

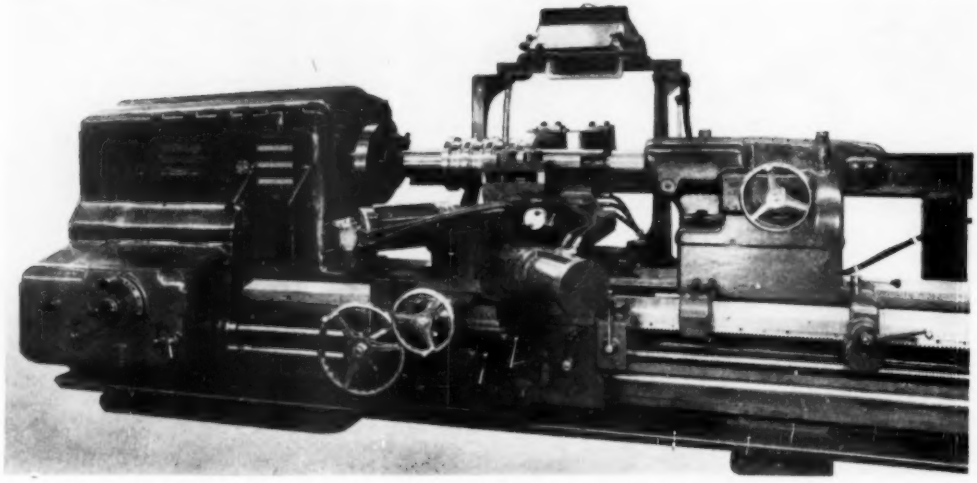
Portable Plant

A WEST COAST PLANT figures that skilled machinists cost $0.10 to $0.30 per minute. Base rate is $1.50 per hour, plus workmen's compensation and overhead, so base labor cost is about $6 per hour. To avoid downtime, company utilizes standard feeds and speeds, does scheduling and die readying in advance so operators lose minimum time during setup.

Plant Garden

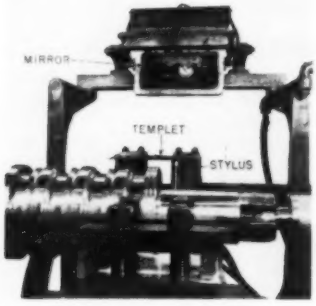
FORD still offers Rouge employes garden plots. 2300 plots, 25 x 60 ft, are offered, at a rental of $2 which covers plowing, disking, and advice from watchmen-gardeners. 1200 men will produce $170,000 worth of vegetables on these plots this year, compete for prizes and ribbons at a gardening and canning show and in a garden rating.

New Shop Equipment



A dual-slide all-hydraulic duplicating mechanism on this American Tool Works lathe controls the machine's cutting tool as it reproduces the desired roll shapes from a templet. Lathe is powered by a 40-hp motor and machines rolls up to 26 in. dia.

Hydraulic Lathe Reproduces Desired Shape from Templet



Compound mirror at rear of carriage shows operator relation between templet and duplicating mechanism. Chilled iron roll (65 scleroscope hard) shown in lathe was completely finished from block in 6 hours.

The chilled iron roll (65 scleroscope hard) shown on this American hydraulic-roll duplicating lathe was completely finished from the blank on this machine in six hours; 3½ hours for the roughing and 2½ hours for the finish turning and facing.

A dual-slide hydraulic duplicating mechanism controls the machine's cutting tool as it reproduces, from a templet, the desired roll shape on either chilled iron or steel roll blanks. Mechanical feed is continuous. Tracer-controlled angular slides give stepless generation of the contours.

The lathe is driven by 40 hp constant-speed motor and machines rolls up to 26 in. A micrometer dial graduated in thousandths and reading directly on the work diameters is located on the adjusting handwheel for accurately determining the diameters desired. Side positioning of the tool in relation to the roll blank is accomplished by a micrometer adjustable templet support bar. A compound clear-vision mirror located at the rear of the carriage above the templet shows the operator the exact relation between the templet and the stylus.

The headstock is the conventional Pacemaker lathe headstock providing 26 speeds in close increments. Cutting tools are held in a massive 4-stud toolholder and the long tools are supported by underneath adjustable supports. Standard round-nose cemented-carbide cutting tools are used for both the roughing and finishing operations.

The American Tool Works Co., Pearl St. at Eggleston Ave., Cincinnati 2, O.

End Mill Formed From Solid Carbide

Completely formed from solid carbide, this tool is designed for production runs on close tolerance slotting and keyway cutting operations in cast iron, mild heat-treated steels and all types of non-ferrous, nonmetallic materials. The tool is available in straight or spiral-flute design in sizes ranging from 3/16 to ⅝ in.

Wendt-Sonis Co., Hannibal, Mo.

Materials and Parts

1 *Complete with bonded abrasive segments, segment clamping devices, and chuck plate, four-segment chuck is ready for mounting. Socket-head screw in foreground regulates segment advancing shelf. Screw at right holds bronze toe-piece. Leather friction pads on segments, for maintaining snugness, are seen extending above the top of the clamping device.*

2 *Bottom of clamping device and segment shows screw holes by which unit is secured to chuck plate. Segment is shaped for high sweeping action to obtain maximum dust and grit removal. Number of segments installed on a complete chuck unit varies from 3 on the 15-in. plate up to 15 segments for the 60-in. plate.*

Standard Grinding Segments Fit Wide Range of Chuck Plates

Embodying a sweeping action which clears grit and dirt from the cutting path, the AA Segmental Grinding Chuck unit employs bonded abrasive segments and holding devices which are interchangeable among a wide diameter range of chuck plates

Two different sizes of AA Grinding Segments will fit a range of AA Chuck Plates from 5- to 60-in. dia. The large size AA-1 grinding segment accommodates chuck plates of 15- to 60-in. dia and the smaller AA-2 segment covers the 5- to 15-in. dia range. The results—decreases inventory requirements.

The crescent-shaped bonded abrasive segments are positioned to develop a combination plowing and centrifugal action which is reported to remove most grinding chips and dirt from the cutting path. The action is said to result in faster, truer cutting, less-frequent abrasive dressing, and a finer finish than ordinary wheels of the same grain.

Abrasive segments are held in two-piece lightweight alloy segment clamping devices, bronze toe-pieces of which are secured by means of socket-head screws. Segments are removed from the clamp by merely loosening this screw. A shelf arrangement in the clamping device facilitates advancing the segment two positions as it wears down. All but one inch of the abrasive can be used. Low cost per unit volume of usable abrasive is listed by manufacturers as one of the big advantages of the segmental grinding chuck.

Segment clamps are available for special installations. They bolt and dowel directly to individual designs of mounting plates. Each clamping device is secured to the chuck plate with socket-head screws. Inherent dynamic balance of the chuck is maintained in operation because clamps are tightend on arc of rotation rather than on radius of chuck mounting-plate.

Coolant can be fed directly in front of each segment, facilitating easy and efficient cooling of the work. Any number from 3 to 15 segments are secured to one chuck unit, depending upon chuck-plate diameter.

Chuck-clamping devices and backing plates are manufactured exclusively by the Abrasive Machine Tool Co., East Providence, R.I. Abrasive segments, however, are produced by several companies throughout the country.

Abrasive Associates, 1216 Industrial Trust Bldg., Providence 3, R.I.

...INCLUDING

Tap-point relief grinder has ground four-flute ½-in taps at 300 per hour. Adjustable for two to five flutes.....page 156

Universal hydraulic grinder with double-end wheelhead does external, internal, and face grinding. Internal spindle speed is up to 35,000 rpm.....page 157

Table lathe requiring small floor space has 1⅝-in. hole through spindle.....page 158

Locking insert for hexagonal nuts is chemically treated to resist moisture and dryness....page 160

Diehead with internal trip permits setting stops on turret so normal pull-off action trips the diehead.....page 162

Magnetic perforating punches and dies are assembled in templet mounting plates, adapted to various jobs by changing the templets .....page 166

Bandsaw fixture permits circular feed adjustable to 5 to 18 in. diameter.....page 168

...and in Oct. 20

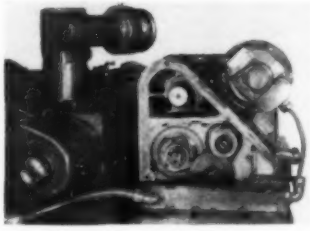
Contour saw and band filer has speeds to 4100 blade fpm for wood and plastics and 92 blade fpm for metals.

Electronic gaging and sorting equipment will be built in special models to suit work tested. It is claimed to have stable operation and easy manipulation of sensitivity.

Hydraulic press, first of a new series, has simplified circuit with a reduction in amount of piping and valves.

Landis Tool tap-point relief grinder processes 300 ½-in 4-flute taps in an hour. Worktable rotates to accommodate tap angles from 0 to 65°. Work speed, controlled by knob on handstock, ranges from 46 to 200 rpm.

Landis Grinder Handles Tap Reliefs on Production Basis



Chain gears shown above regulate setup for varying flute arrangements. Calibrated wheels are for eccentric adjustment. Motor above them is for headstock drive. Knurled knob at left is wheel reciprocation control.

The Landis Tool tap-point relief grinder will accommodate taps from No. 2 to 1-in. dia. It is reported to have ground four-flute ½-in. taps with .010 in. relief at the rate of 300 per hour. The headstock can be adjusted for two-, three-, four- and five-flute taps and the eccentric adjustment provides for up to .030 in. relief on the tap.

Headstock motor is 1/3 hp variable speed and work speed range is from 46 to 200 rpm. The worktable swivels to accommodate tap angles from 0, to 65°. A 3-hp. motor drives the 16- x 1- x 5-in. grinding wheel, which is mounted on the right-hand side of the wheel base. A hydraulic wheel dressing device is mounted on the wheel base. Full adjustment for worm wheels as well as hydraulic controls for speed and direction are provided. The wheel base is advanced to the work by hydraulic rapid infeed after which slow grinding feed, adjustable as to amount and rate begins. After a hydraulically timed period of spark out, the wheel bases automatically retract into the back position.

Spindle drive is through vee belts. Gears are used only to regulate the rocking action on the cradle. All moving parts are mounted on precision preloaded ball bearings.

Landis Tool Co., Waynesboro, Pa.

Aluminum Periphery Marker Cast in One Piece

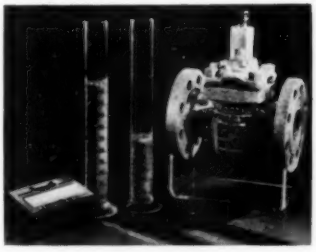
Fitted with floating springs for retaining stamps, the Cunningham "Luminum-Line" periphery marker stamps outer circumferences of pipe tubing, axles, large shafts, and other rounded products. Cast in one piece from a tough-grade aluminum alloy, this marker is 50% lighter than the old model, but is said to withstand harder wear and longer service. Channel beading around stamp slots prevents off-angle hammer blows. Holders are furnished with either one or two rows of stamps, and handles are available to suit any type of marking requirement.

M. E. Cunningham Co., 95 E. Carson St., Pittsburgh, Pa.

Miniature Electrode Holder Has Flexible Front End

Designed for the fluxless welding of non-ferrous metals in the thinner gages from No. 16 to No. 40, this miniature inert-arc electrode holder has a flexible front-end assembly made of malleable copper tubing surrounded by a sheath of silicone rubber. It can be bent in any direction to reach hard-to-get-at places. The holder is available in two models: one for 0.010- and 0.020-in. tungsten electrodes, and the other for 0.040- and 1/16 in. tungsten electrodes. It has a rating of 40 amp continuous and can operate with either ac or dc supply.

General Electric, Schenectady 5, N.Y.



Expansible Lubricant Plugs Pressurized Plug Valves

Hypermatic grease compound is said to be volumetrically flexible and capable of storing energy for long periods to give automatically to its feeding action. For lubricating pressurized plug valves, this material would act as an automatic force-feed seal in case of leaks. According to manufacturer, if valves have been neglected, but are lubricated with Hypermatic, they would be kept in a state of 100 percent lubricated condition and remain energized.

Compressible from 50 to 100 percent, more of this grease can be inserted and stored for future use.

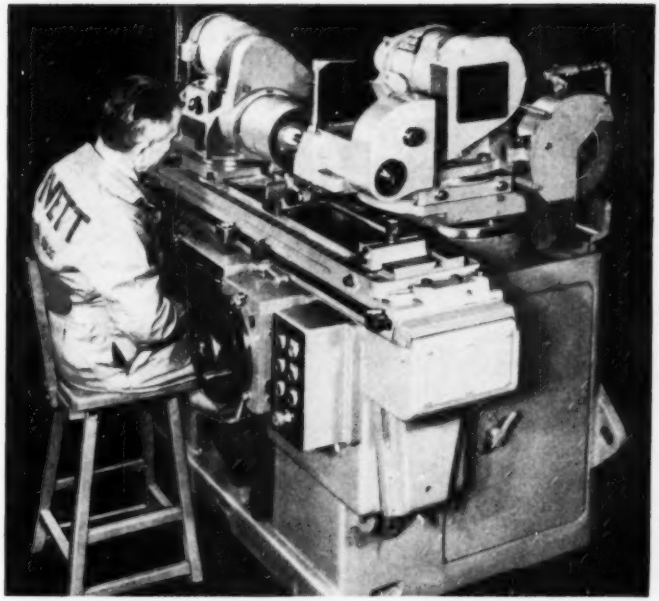
Turning of the lubricant screw builds up the energy. The lubricant will actuate with pressure of as low as 50 lb. In very high pressure service the energy is built up to 1000 lb. and higher. When pressure is finally exhausted Hypermatic functions the same as non-energizable valve lubricant, but by compression can be re-energized.

Rockwell Mfg. Co., 500 N. Lexington Ave., Pittsburgh 8, Pa.

Kennametal Tools Machine Grooves to V-Belt Dimensions

Kennametal Tools, styles VG and SVG are designed for machining grooves to the dimensions recently approved by the Multiple V-Belt Drive and Mechanical Power Commission Association. The tools are supplied in two types: one having brazed-on Kennametal blank, and the other with Kennametal blank mechanically held by a socket-head capscrew.

Kennametal Inc., Latrobe, Pa.

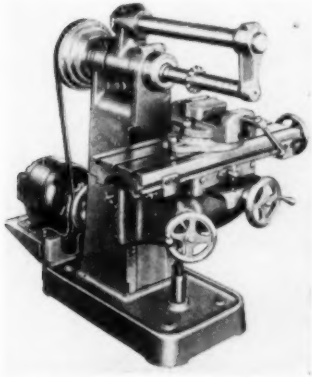


Universal Hydraulic Grinder Has Double-End Wheelhead

Equipped with a double-end wheelhead which mounts both external and internal spindles, the 1020 Universal Hydraulic Grinder can be adapted for internal, external and face grinding. The workhead spindle is infinitely variable from 100 to 600 rpm and is adjusted by the turn of a dial.

A hydraulic table traverse allows adjustment and length from ⅜ to 24 in. in rates of 3 to 400 ipm. Internal grinding spindles are available with correct speed and wheel mounting for any hole within the machine's capacity. These speeds range from 6,000 to 35,000 rpm. Maximum diameter of external grind—approx. 10 in., maximum length of external grind—18 in., and range of internal grinding diameter is roughly ⅛ to 9 in.

Rivett Lathe & Grinder, Inc., Brighton 35, (Boston), Mass.



Benchmaster Miller Equipped With Telescopic Vertical Screw

A telescopic screw enables the Benchmaster Miller to operate on any bench or stand without drilling the table top for the screw to extend beneath. This unit can operate as either a horizontal or vertical mill by substituting spindle assemblies. The large miter gears operating the new telescopic section are said to give greater smoothness and ease of operation on vertical adjustments. The Benchmaster has a 6- x 18-in. table with a longitudinal travel of 12½ in. Traverse feed is 5½ in., and vertical travel 8½ in.

Benchmaster Mfg. Co., 2952 W. Pico Blvd., Los Angeles 6, Calif.

L & R Machine Cleans Small Parts Automatically

Including hydraulic and mechanical operation the L & R Automatic is equipped with a complete set of baskets, dividers, and L & R cleaning and rinsing solution. Parts to be cleaned are placed in suitable baskets which are then snapped to the motor shaft. The starter button is pressed and the rest of the operation is automatic. The complete cycle including washing, rinsing, and drying is completed in 12 min.

Basket size range from 2¼-in. ID by 1¾-in. depth to 1¾-in. ID and ¼ in. depth.

L & R Mfg. Co., 577 Elm St., Arlington, N. J.

Panelette Available in 12-, 16-, 20-Circuit Combinations

The MO Panelette is equipped with thermal-magnetic circuit breaker units that "plug-in" on cylindrical bus bars and are interchangeable with those of the NMO panelboard. The plug-in feature simplifies changes or additions of circuits when load increases are necessary.

Designed particularly for the type of wall construction prevalent in homes, schools, apartment houses, office buildings, and industrial plants, these units are only 12 in. wide and 4 in. deep, permitting surface or flush installation in shallow walls with studs on 16-in. centers.

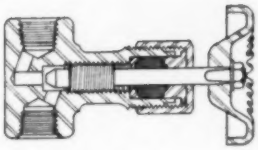
Square D Co., 6060 Rivard St., Detroit 11, Mich.

Wear Strips Minimize Sizing and Galling

Cast from Ampco Metal Grade 21, these aluminum bronze wear strips for boring bars and driving tools piloted in bushings are said to minimize sizing and galling caused by high speeds, heavy loads and adverse operating conditions. Wiping action of strips keeps chips and dust particles away from mating surfaces of bushing and bar. They have low coefficient of friction and good heat conductivity.

Wear strips are available in 6-in. lengths and five standard sizes. All are 6-hole type, capscrews furnished. The five standard widths are ⅜, ½, ⅝, ¾, and 1 in.

Scully-Jones & Co., 1902 S. Rockwell St., Chicago, Ill.



One-Piece Needle Valve Eliminates Leakage

Built with tapered-point needles for closer flow control and leakproof seating, this Norgren high-pressure needle valve is designed for control of air, fluids, and gases under pressures up to 3000 psi. The valve stem is hard chrome plated for maximum service life.

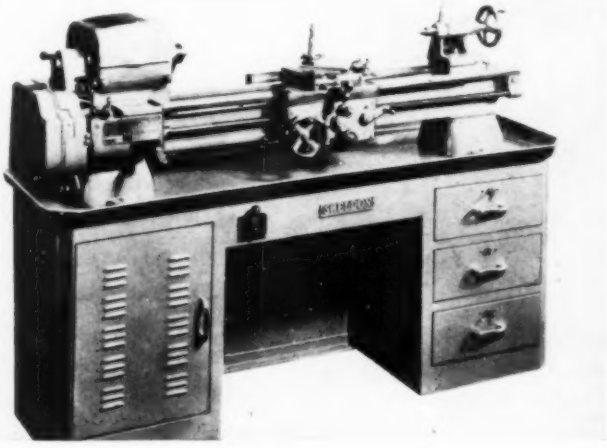
Three types are offered: Globe, Angle, and Tee in ⅛- and ¼-in. pipe sizes. Each type is manufactured in three materials: Brass, Steel, and Stainless Steel. Steel-bodied units are cadmium plated and the brass and stainless steel bodies are finished natural. Valves have large easy-grip adjusting wheels.

C. A. Norgren Co., 222 Santa Fe Drive, Denver 9, Colo.

Broaching Kit Available As Packaged Unit

The Standard SB-50 broach kit consists of a 1-in. dia Glenny broach, four interchangeable cutting blades, five eccentric bushing-type adapters and a sturdy metal carrying case. Blade widths are ⅜, ¼, 9/32, and 5/16 in., and eccentric adapters permit keyway cutting in bores of 1⅛, 1-5/32, 1-3/16, 1-7/32 and 1¼ in. Kits are available equipped with standard ⅜-, ⅝-, ¾-, 1-, or 1¼-in. dia broaches.

The Kase Machine Co., 18422 Buffalo Ave., Cleveland 19, Ohio



Sheldon Table Lathe Has 10-in. Swing

Designed to meet the need of factories and school shops for lathes of large collet capacity, but requiring small floor spaces, this lathe has a 1⅜-in. hole through the spindle. It also has a four-speed (eight spindle speeds) V-belt underneath motor drive; full double-walled worm feed apron; full quick change gears; full inclosed headstock with hinged cast aluminum cover; and standard operator controls. Known as the "XL" series this lathe is available with 38- and 44-in. bed length on a three-drawer steel bench, or with pedestal base in bed lengths up to 62 in.

Sheldon Machine Co. Inc., 4258 N. Knox Ave., Chicago 41, Ill.

NEW ALTITUDE RECORDS in assembly and sales...

...both are "jet-assisted" by AMERICAN PHILLIPS SCREWS

NEW ALTITUDE MARKS IN ASSEMBLY Savings zoom skyward when American Phillips Screws take over the cost-controls in any assembly operation. *Time-savings alone climb as high as 50%* . . . over old-fashioned, slowpoke, fumble-and-fume slotted screws! Meanwhile spoilage and rejects . . . yes, and lost-time accidents, too . . . are grounded once and for all.

NEW ALTITUDE MARKS IN SALES Next time you board a commercial airliner . . . or *any* plane, for that matter . . . look around you and see what the aviation industry thinks of American Phillips Screws. *They use almost nothing else but!* And aside from the assembly savings and the vibration-proof fastenings, there's another customer-consideration in there, also . . . because there's never a burr on a Phillips head to snag clothes or scratch hands. Buyers of everything from airplanes to zithers, what's more, are coming to recognize *and look for* the American Phillips crossed recess as a sure surface index of inbuilt quality in *any* product. Does *yours* have this sales advantage? Just write:

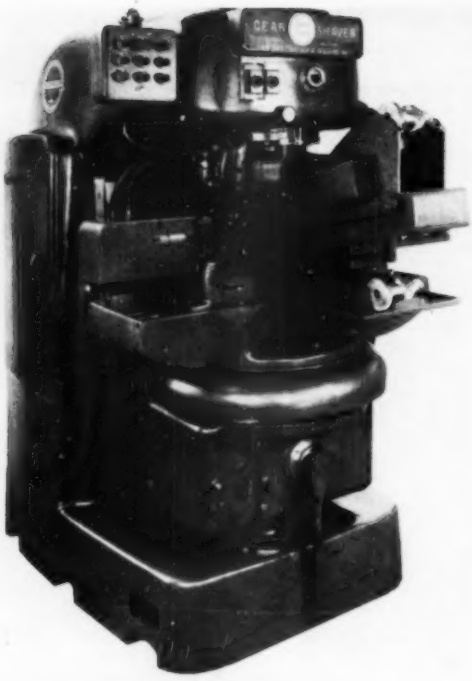
AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois St. Norristown, Pa. *Detroit 2:* 502 Stephenson Bldg.

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN PHILLIPS *Screws*

ALL TYPES
ALL METALS: Steel, Brass, Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

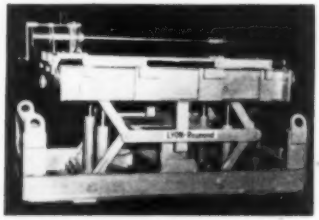


Gear Machine Shaves External Gears Automatically

Model GCU diagonal-gear shaving machine and automatic loader illustrated here is shaving a 32-tooth constant-mesh transmission gear at the end of a cluster. This is a helical gear having 3.765 PD, 10.5 DP and a $\frac{5}{8}$-in. face. The blank has an overall length of 5.809 in. and a .875-in. diameter broached hole running throughout its length. At 85% efficiency, 191 gears are processed per hour.

The machine runs continuously as long as the magazine is kept filled with work. An unskilled machinist can keep magazines of several automatic loaders filled and all machines running continuously.

National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich.

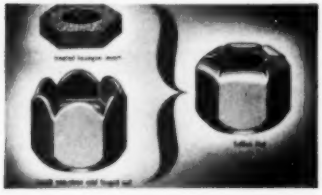


Hydraulic Die Handling Truck Has 20,000 Lb Capacity

Equipped with (1) four hydraulic lifting cylinders, (2) motor-driven hydraulic pump, (3) provisions for inserting and removing die slings, (4) hand winch, (5) retractable wheels, and (6) roller top, this heavy-duty hydraulic die-handling truck has a range of elevation from 28 to 44 in. Dies are transported to and from die storage by means of an overhead crane. When the die is placed on the die table the platform is in lowered position; six vertical posts extend up between the rollers 2 in. to support the die and allow the slings to be removed. A winch arrangement draws dies from presses to the table and by means of sheaves transfers them from the table to the press. The winch has a 96 to 1 ratio enabling it to handle the heaviest dies.

Retractable wheels allow the empty table to be easily moved into position, but when loaded, the table rests on a base support for proper stability.

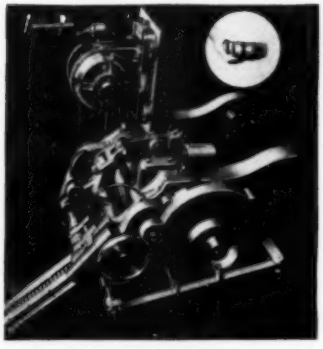
Lyon-Raymond Corp., 4751 Madison St., Greene, N.Y.



Cold-Forged Nut Has Hexagonal Locking Insert

The hexagonal locking insert in the cold-forged Townsend Tufflok Nut is chemically treated to resist both moisture absorbing and drying which, in the past, have caused locknuts to loosen. This nut is now available in sizes 4 to $\frac{3}{8}$ in.

Townsend Co., New Brighton, Pa.



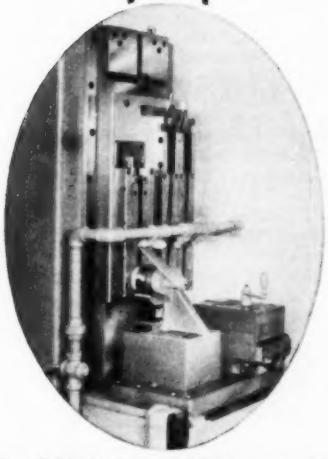
Rockwell Threader Trims, Beads, Knurls, and Curls

The Rockwell No. 302 threading and trimming machine, in addition to threading and trimming, can also be utilized for beading, knurling and curling either as separate operations or in combination. Parts are placed in a chute by the operator, automatically fed to the chuck, processed, and automatically ejected at a rate of 35 per min. By an interchange of chucks different sized units can be handled. The V&O Threading and Trimming Machine stands 44½ ft high, measures 5½ ft from front to back, and is 6½ ft wide. It is powered by 2 hp, 900 rpm motor using V-belt drive.

V&O Press Co., Div. Rockwell Mfg. Co., Hudson, N. Y.

Now— A BROACHING MACHINE THAT WILL DO ALL 4

1. Internal Push Broaching
2. Surface Broaching
3. Slotting
4. Press Work



at a price far below single-purpose ram type broaching machines

Available in 4, 6, and 10 ton capacities and in 24 and 36 inch strokes

The New "Ram-Press"

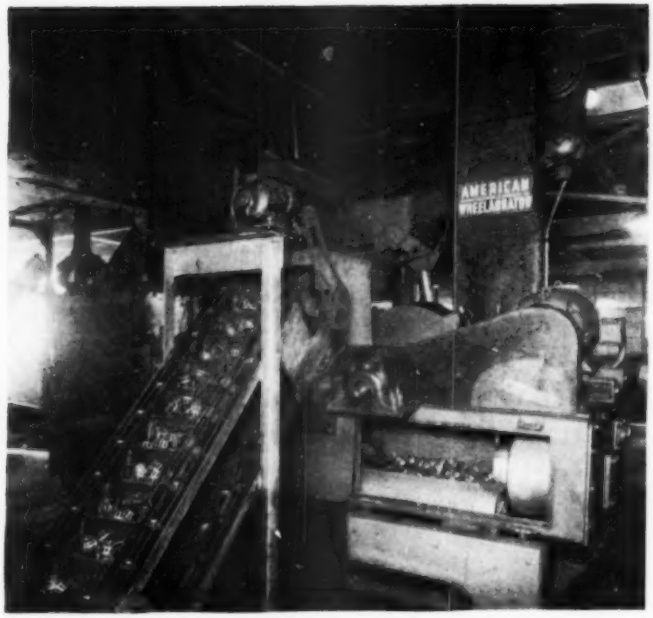
PIONEERS OF H.S.S. BROACHING

COLONIAL

BROACH CO. DETROIT 13

For complete information on this revolutionary machine—designed to bring the cost of broaching equipment within the reach of practically any plant—no matter how small—

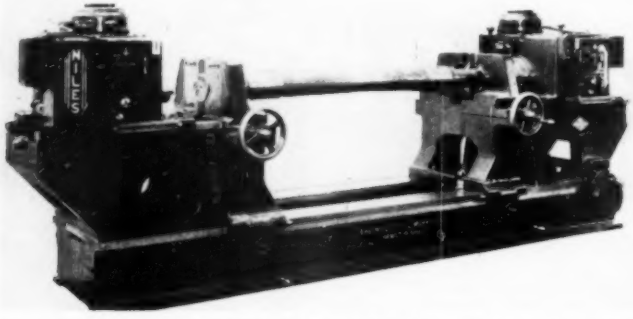
Ask for Bulletin #RP-49



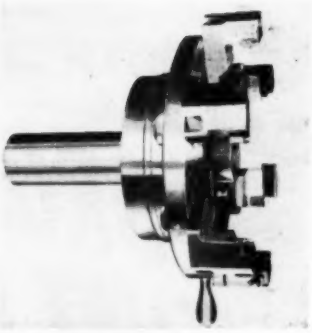
Wheelabrator Tumblast Cleans Continuous Flow of Small Parts

The smallest machine in the Wheelabrator Tumblast line, this unit has a 15 in. diameter blast chamber. Work enters the machine by means of the conveyor at the left and is dropped into the blast chamber. Here it is tumbled by a continuous, rubber, belt conveyor in the abrasive blast of an overhead abrasive unit. Cleaned work passes out of the right end of the blast chamber. A shaking screen recovers any abrasive that may have been carried out with the work and returns it to the cycling system for reuse.

American Wheelabrator & Equipment Corp., 555 So. Burkit St., Mishawaka, Ind.



HYDRAULIC-FEED AXLE CENTERING MACHINE both centers new axles and renews centers on either mounted or unmounted axles prior to turning operations. It also checks wheels for concentricity of journals with reference to the periphery of the wheel. Axles may be chucked on the collar, on the journal or on the wheel seat. Axle chucking units are adjustable with respect to length and diameter to accommodate various sizes of axles.—*Nile Tool Works Co., Div., of the Lima-Hamilton Corp., Hamilton, Ohio*

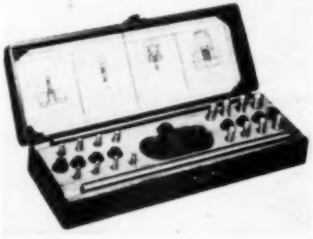


Internal Trip Diehead Threads 14-in. Valve Rings

The 40AXX Landmatic diehead threads valve seat rings up to diameters of 14¾ in. The internal trip arrangement permits setting the stops on the turret so as to allow the normal pull-off action to trip the diehead.

For thread sizes larger than 9-5/16-in. dia an enlarged closing ring is mounted on the head to support the oversize chaser holders. Varying thread lengths of different valve seat rings can be taken care of by the height of the oversize holders. Coarsest pitch recommended is 8 threads per inch. The chaser holders have a diametrical adjustment of approximately 5/8 in. on the larger size. This permits the same chaser holders and chasers to be used for different diameters.

Landis Machine Co., Waynesboro, Pa.



Pierce Die "Button" Extractor Removes Inserts in Four Steps

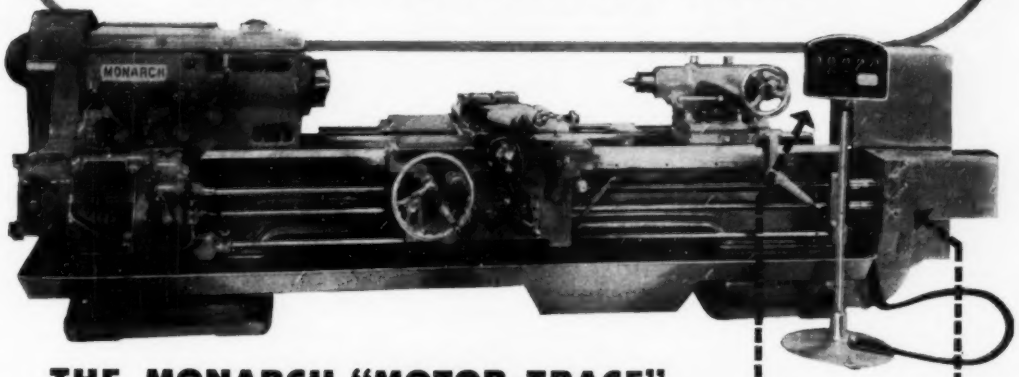
The EZ-PUL pierce die "button" extractor requires four steps to pull straight or taper hole inserts without removing dies or die sections from the press. The tool is also said to be valuable for quick removal of bearings, bushings, liners, and sleeves.

Two standard sets are available to pull inserts from .2031 through .7031.

L. C. Ball Associates, 2276 National Bank Bldg., Detroit 26, Mich.

Announcing—

ANOTHER OUTSTANDING MONARCH TRACER CONTROLLED LATHE



THE MONARCH "MOTOR-TRACE"

For fast, repetitive shaft turning at its economical best you need the new Monarch "Motor-Trace"—an automatic cycle, electric motor operated, electric tracer controlled duplicating attachment available on any standard Monarch lathe, 14" or larger.

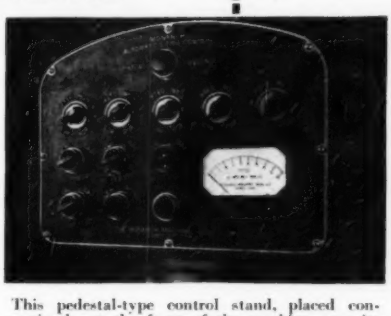
Tracing is done either from gage blocks, micrometer heads or a template. This readily adapts it to straight, multiple diameter shaft work in any desired size within the capacity of the machine. Unbeatable on long production runs, it also is recommended for its ability to cut costs on exceedingly small lots, because of the simplicity of micrometer head setup.

As the completely automatic cycle is finger-tip controlled from a single pedestal-type station, one man can operate two machines, *easily*. An equally important economy feature is the ability of the "Motor-Trace" to be disengaged in less than thirty seconds, allowing quick conversion to conventional engine lathe operation.

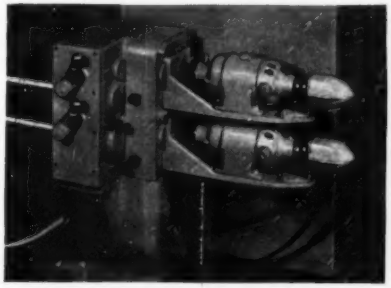
You'll want to investigate how these features and others fit the "Motor-Trace" for "*peak production at a profit*" in your shop. Be sure to ask for complete information.

THE MONARCH MACHINE TOOL CO.
Sidney, Ohio

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

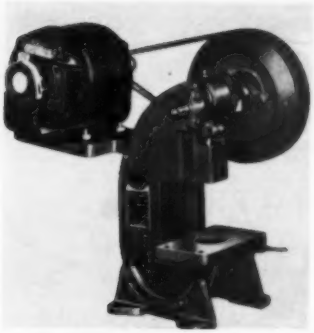


This pedestal-type control stand, placed conveniently at the front of the machine, permits complete control of the fully automatic cycle from a single point. For maximum machining efficiency, as many as five different feeds may be preselected.



"Motor-Trace" drive motors, electronically controlled, take responsibility for feed change and fast carriage return out of operator's hands.

FOR A GOOD TURN *FASTER* — TURN TO MONARCH



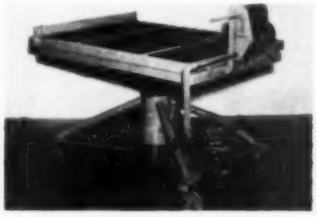
Pint Sized Punch Press Handles Small Jobs

Performing all conventional operations such as punching, shearing, staking, riveting, forming, and coining, the Benchmaster Midget has a capacity of "one ton plus" under continuous heavy-duty operations. It has a standard maximum stroke of ¾ in. with ¾-in. hole in ram. Shorter strokes are available on special order. Approximate speed with a 1725 rpm motor is 290 strokes per minute, a ¼-hp motor being recommended.

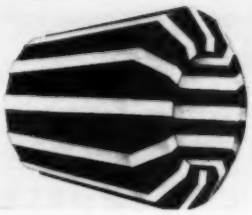
The alloy steel crankshaft is ¾-in. OD-rotating in replaceable bronze bushings. It is equipped with a sliding-key type clutch and a 20-lb flywheel of 9 in. Approximate height of the press is 17½ in.; complete weight (less motor) is 65 lb. Throat depth is 2⅛ in.

The Midget sells for $80 f.o.b. Los Angeles.

Benchmaster Mfg. Co., 2952 West Pico Blvd., Los Angeles, Calif.



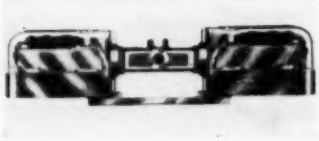
SPECIAL HYDRAULIC DIE TABLE has a 31- x 42-in. top equipped with 13 rollers set on 3-in. centers. A removable retaining bar prevents dies from rolling off the open end of the table. A 35 to 1 ratio hand winch with 15 feet of steel cable pulls dies from presses and storage racks. The table elevates from a lowered position of 22 in. to a top height of 30 in. A single-speed foot pump enables the operator to position dies weighing up to 2000 lb.—*Lyon-Raymond Corp., 2644 Madison St., Greene, N. Y.*



Rubber Flex Collet Has ⅛-in. Gripping Range

Composed of special Hycar synthetic rubber, bonded and mechanically locked to hardened and ground tool-steel jaws, each collet has a full ⅛-in. gripping range. Only 11 rubber-flex collets are needed to chuck any bar between 1/16 and 1⅜ in.

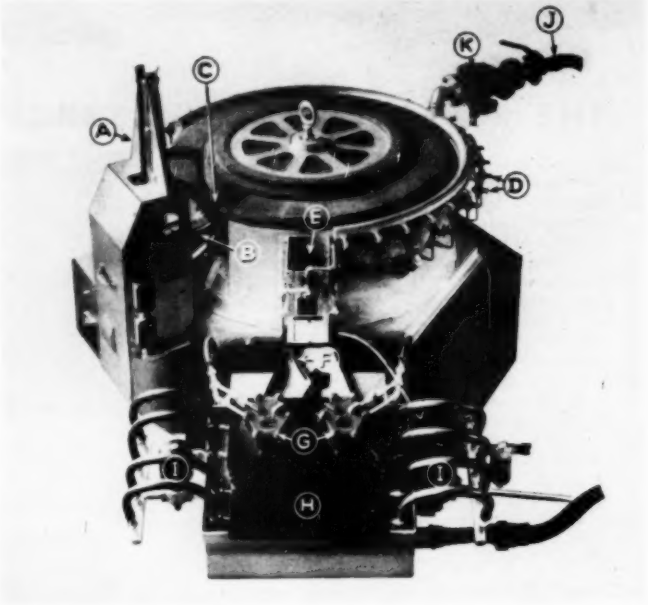
The Jacobs Mfg. Co., West Hartford, Conn.



Double Solenoid Valves Handle Air from 0 to 125 psi

Valvair double solenoid valves for air pressures of 0 to 125 psi are offered in ¼-, ⅜-, ½- and ¾-in. sizes. All are available for 110, 220, and 440 volts in both 50-60 cycle and 25 cycle current. These models come in all sizes: two-way, three-way piped exhaust, and four-way piped exhaust. Each solenoid has a one-piece bronze base.

Valvair Corp., 454 Morgan Ave., Akron 11, Ohio



Automatic Machine Hardens 800 Automotive Plates Per Hour

The loading arm of this automatic radiant gas hardening machine places pieces on the rotary refractory hearth which moves past a series of 24 radiant ceramic gas burners, advancing the pieces at the required temperature and time. At the end of the cycle a nickel-chrome alloy ejector arm moves the piece into the quench chute which is baffled to alternate the delivery of heated pieces to two quenching chambers. High delivery frequency of heated pieces requires two quenching chambers for proper quenching time.

Premixed gas and air in complete combustion proportions are supplied to the machine at constant pressure.

Selas Corp. of America, Erie Ave. and D St., Philadelphia 34, Pa.

Inside story of the

300 TANKS made for rugged ALASKAN SERVICE

They're fabricated from

REVERE HERCULOY

The silicon-bronze alloy of great strength and corrosion resistance

ALASKA is no place for sissies, whether they be men, metals or alloys. Rugged service calls for rugged materials. That's how Revere Herculoy came into this picture. The tanks illustrated, which had to be made to a combination standard of ASME and Army specifications, are of 1250 gal. cap. and made for a working pressure of 127½ lbs. Each tank receives a 300 lb. hydrostatic test before shipment.

Herculoy was chosen for this job because of its unusual properties. This silicon-bronze alloy has the corrosion resistance of copper with the strength of medium carbon steel. It cold-works and hot-works readily and is easily welded by any of the commercial methods, its thermal conductivity being roughly only 10% of that of copper and comparable to that of mild steel, thus high thermal losses of conduction are not encountered. In the case of the tanks shown the welding method employed was the Heliarc process, using ¼" Herculoy rod. Tanks were welded both inside and outside.

Herculoy also has superior fatigue resistance, and is used in operations requiring resistance to alternating and cyclic stresses. It is but one of the many Revere Metals and Alloys and combinations of alloys being used more and more by more and more industries for the really tough jobs. For these industries have found there are many uses for copper and copper alloys of which they had never before dreamed . . . uses that have resulted in substantial savings, longer life, improved performance. They have also found that because of the many years of experience working with copper, Revere Technical Advisory Service can be of real help in solving many of their problems.

So, before placing your next order, why not call the Revere office nearest you?

REVERE

COPPER AND BRASS INCORPORATED

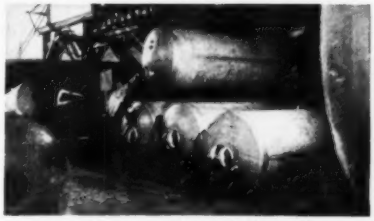
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

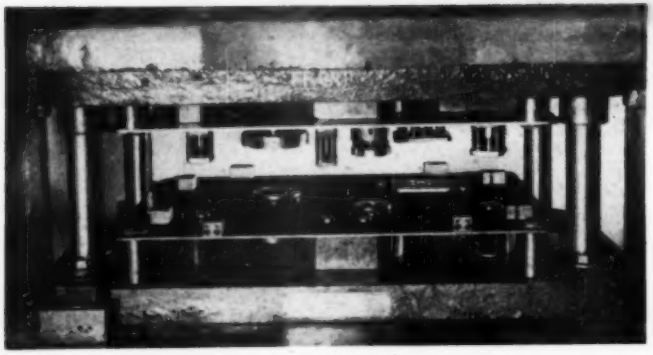
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

ROLL OUT THE TANKS—Here you see a sheet of Revere Herculoy being rolled into cylindrical shape at the H. AMICK SHEET METAL WORKS, Seattle, Wash. Heads are then welded onto both ends of these cylindrical shells.

HOT SHOT FOR COLD TANKS—After welding is completed a removable heating element made of Revere Copper tube is placed into the tank. These elements range in sizes of from 5 sq. ft. of surface to 750 sq. ft.



HEADED FOR THE FROZEN NORTH—These completed tanks awaiting shipment are 48" x 168" and are the largest of the group of some 300 made of Revere Herculoy by H. AMICK SHEET METAL WORKS for use in Alaska.

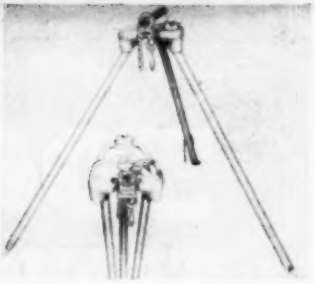


Die Set Made Up with Interchangeable Punches, Dies

Whistler magnetic perforating punches and dies are assembled in templet mounting plates. On completion of any job the punches and dies with their retainers are quickly removed and ready for use in the new arrangement. Only the templets are then stored.

A stock of all standard sizes of punches, dies, bushings, and retainers are maintained by the manufacturer for perforating round, oval, square, and rectangular holes from 1/32 to 3-in. in dia. Special shapes or sizes can be made to order. Tolerances can be held to 0.0005. in or as close as can be jig bored. Die sets can be made up in any size for piercing holes in materials up to ⅛ in. mild steel.

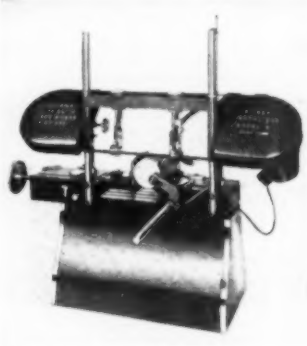
S. B. Whistler & Sons, Inc., Buffalo, N. Y.



Aluminum Vise Stand Has Two Pipe Benders

With special aluminum alloy base which has high tensile and impact properties, the Williams lightweight combination vise, stand, and pipe bender handles from ⅛- to 2-in. pipe. Two pipe benders, one for pipe up to ½ in., and the other for pipe up to ¾ in., are provided. Recess for oil can and handy slots for tools are also included.

J. H. Williams & Co., 400 Vulcan Street, Buffalo 7, N. Y.

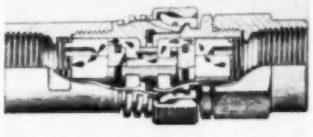


Metal-Cutting Band Saw Has 9- x 18-in. Capacity

Cutting head of the Model M metal-cutting band saw is a one-piece welded construction which includes beams for blade guides and column housing. A quick-action vise on a continuous screw clamps rigidly in all positions. Stock stop automatically moves out and up at completion of cut to eliminate binding of the stock on blade.

All rotating parts operate on ball bearings. The saw capacity is 9x18 in., maximum clearance under the saw blade is 20 in., and the unit requires 20½ in. x 66 in. floor space. The swivel vise moves 45° in either direction.

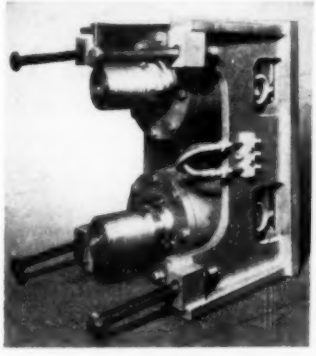
W. F. Wells, North on 131, Three Rivers, Mich.



Inst-O-Matic Coupling Is Self-Sealing, Leak-proof

Reported to have very high flow characteristics, the P-1900 Series ¾ in. double self-sealing coupling shuts off both ends of the line when uncoupled with minimum loss of fluid. It is designed for low and medium pressure air, gas, and fluid applications. Over-all coupled length is 4-15/32 in., maximum clearance 5¼ in., maximum OD 1-21/32 in., weight in brass 1 lb, and is priced at $5.95.

E. B. Wiggins Oil Tool Co., Inc., 3424 East Olympic Blvd., Los Angeles 23, Calif.



End-Thrust Bearing Available As Separately Attachable Unit

Containing a double-direction, anti-friction thrust bearing mounted on a pin which fastens to the roll, this end-thrust bearing is designed to work with conventional plain radial bearings on rod or bar mills.

This unit eliminates conventional wearing-type side-thrust collars and is said to allow precision control over axial matching of roll passes. An outer casing bolted permanently to the roll-housing incloses these roll-controlling cartridges and by means of a simple thread push-pull device allows for the length-wise adjustment of each roll and for its locking in position after groove matching.

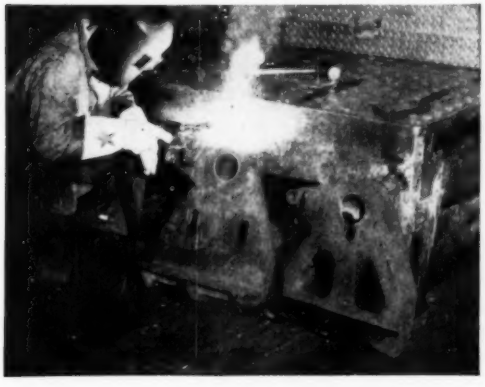
Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh 3, Pa.

ARC WELDING CUTS SHOP LOSSES ...lowers manufacturing costs

By A. G. Kullberg, Assistant Chief Engineer
Bay City Shovels, Inc.
Bay City, Michigan

By converting many of our power shovel parts over to welded construction, we have cut our manufacturing costs. Component parts that once required several weeks to complete are now being produced in as little as 10 days. Important also is the greater flexibility gained by reducing the number of patterns and the dependency on outside sources for cast materials, thus permitting product changes more quickly and at less expense.

Many of our power shovel parts are now fabricated from steel plate and from standard mill shapes. Formed parts are held in simple clamp fixtures and assembled by arc welding with Lincoln "Fleetweld 7" electrodes and Lincoln "Shield-Arc" DC welders or "Fleetwelder" AC arc welders. The AC arc welders are used on boxed-up members where arc blow otherwise limits the use of high welding currents.



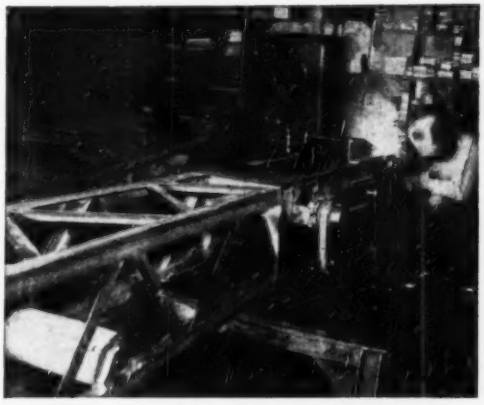


Fig. 1. *Rigid, strong and lightweight . . . This sheave-cage-to-boom assembly is typical of the high quality achieved at Bay City Shovels, Inc., Bay City, Michigan, with Lincoln "Fleetweld 7" electrodes and "Fleetwelder" AC machines.*

Our shop today is using arc welding to fabricate such shovel parts as buckets, booms, power transmission gear cases and motor mounts where strength is a prime requisite. We also build many of our smaller operating parts like handles, links and levers with arc welding—including sheet metal work up to 12 gauge for guards and cabs.

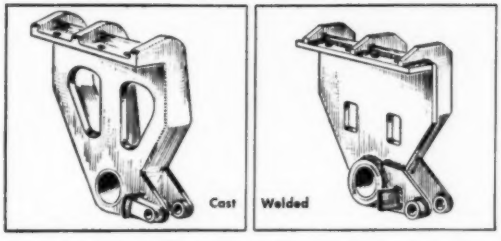


Fig. 2. Lowers cost 30% on Dipper Handle Yoke . . . *Eliminates need for more costly castings by fabricating part from lower cost steel plate and standard mill shapes.*

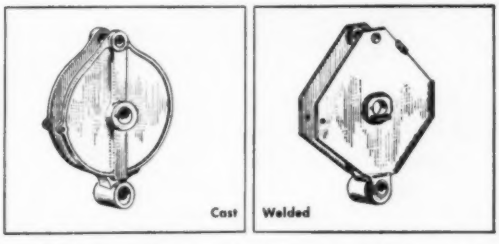
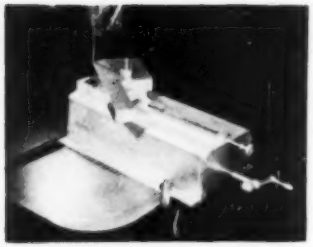


Fig. 3. Cuts material costs 54% on Dipper Sheave Cage . . . *Also eliminates excessive straightening and chipping formerly needed before machining. Total cost reduction on this part is 28%.*

The above is published by **THE LINCOLN ELECTRIC COMPANY** *in the interests of progress.*
Machine Design Studies are available to engineers and designers. Write on your letterhead to The Lincoln Electric Company, Dept. 108, Cleveland 1, Ohio.



Band Saw Fixture Permits Circle Feed

The Hamilton automatic band saw fixture permits a circle feed in diameters from 5 to 18 in., cutting material up to 2 in. in thickness. The feed mechanism is driven by a spring motor. All gears and the motor are inclosed to reduce maintenance required by dirt and steel cuttings. The attachment will run for 5 min automatically, stopping when the piece is cut. It cuts with 1/64-in. tolerance.

Columbus Special Machine Co., Columbus, Ind.

"Chatter-Free" Countersinks In 30, 41 and 45° C/L Angles

Made of high-speed steel, this line of Severance "Chatter-Free" Econo-Sinks come in six sizes ranging from ¼- to 1-in. OD. When dulled they can be reground by manufacture. A set of six are priced at $14.50.

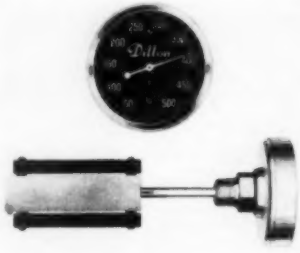
Severance Tool Industries, Inc., Saginaw, Mich.

Air Tapping Unit Operates on Traversing Rotor Principle

The rotor of this air-operated tapping unit shifts for the full length of the stroke so that the motor shaft can be made solid providing for extreme rigidity and accuracy. The unit is operated by air through a double-acting air cylinder controlled by a built-in, four-way air valve. Adjustable needle valves control the flow of air.

Reversal is obtained through a secondary air cylinder, operating from the same air supply as the main cylinder. A limit switch reverses the motor when the tap has reached the proper depth. Depth control is held within 0.001 in. Units are designed to work in any position and at any angle.

Black Drill Co., Div. of Black Industries, 1400 E. 222nd St., Cleveland 17, Ohio



Magnetic Thermometer Has Flat Stem

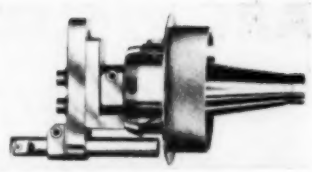
Capable of withstanding more than 3476 psi pressure the Dillon Flag Stem Magnetic Thermometer was designed for application on such items as electric flatirons, griddles, transformers, engine blocks, air ducts, and exhaust ports. It can be placed on flat surfaces and peeled off immediately. The large flat base is said to quickly gather and retain heat from the surface under test. Available in either Fahrenheit or Centigrade calibration the unit is made with stem lengths ranging from 3 to 42 in., and with 1-, 2¼-, 3-, and 5-in. dia dials. Made of 18-8 stainless steel the thermometer is acid and rust resistant.

W. C. Dillon & Co. Inc., 5401 W. Harrison St., Chicago 44, Ill.

Microscopic Attachment Provides Bright, Dark, Polar Illuminations

The Tri-Vert illuminator can be readily attached to the body tube of standard non-objective microscopes for examination of opaque or semi-opaque specimens. Vertical illumination is attained by a titanium-oxide coated glass reflector plate. The periphery of the plate is illuminized for dark field beam and has a clear center for bright field and polarized light. A polaroid polarizer and cap analyzer provide for polarized light examinations.

Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N.Y.



Offset Boring Head Equipped with Facing Extension

Equipped with a direct reading friction-type dial for accurate adjustment, Everede offset boring heads are manufactured in three sizes for use on any type boring machines or turret lathes. Boring heads are made of hardened ground alloy tool steel and have maximum bearing surfaces to keep chattering on heavy cuts to a minimum.

Extension attachments furnished for the larger and intermediate sizes of Everede boring heads increase their capacity 50%. Facing operations are performed with removable knurled collar containing retractable pins that permit either a 0.0025 or 0.005 feed per rev.

Everede Tool Co., 2000-06 North Parkside Ave., Chicago 39, Ill.

Multiple Spindle Drillhead Cuts Variety of Patterns

Designed to reduce multiple drilling costs by eliminating expensive changes in setup from job to job, the Adjustafix multiple spindle drillhead can be used for drilling, tapping, reaming, spot-facing, boring, counterboring, and milling operations. The number of drill patterns possible with this drillhead is limited only by the number of pattern plates available.

Though designed principally for multiple operations, this unit can be adopted to single spindle operations. It has fully automatic lubrication for either horizontal or vertical operations.

U. S. Drill Head Co., 616 Burns St., Cincinnati 4, Ohio

PRECISION HOLES Cost Less

with these LELAND-GIFFORD features

- Spindles individually driven by totally enclosed, fan cooled, ball bearing motors.
- Indicating Shift provides instant speed selection *without stopping machine.* Four standard speeds with four additional speeds available through back gearing.
- Six-splined, independently counterbalanced alloy steel spindles with preloaded radial-thrust bearings and continuous lubrication.
- Built-in light for each spindle completely illuminates work.
- Ratchet adjustment of sensitive hand feed lever.
- Box type ribbed table with platen machined to surface plate accuracy.
- Maximum rigidity insured by rugged construction of base, column and table.
- ★ Semi-Automatic Power Feed with three feed rates and positive, adjustable depth stop.
- ★ Plain or Step-by-Step hydraulic feed with infinitely adjustable feed rate and automatic overload release.
- ★ Reversing motor or high speed, ball bearing friction attachments for tapping at drilling speeds.

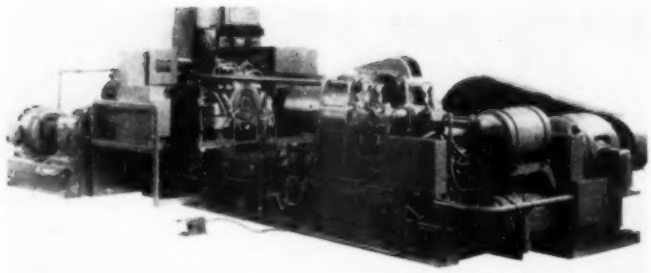
● *Indicates standard features* ★ *Optional extra features*

LELAND-GIFFORD
No. 2 LMS
Meter Spindle
Drilling Machine
Speed, Range, Accuracy . . .
a precision machine tool designed for low cost production drilling and tapping in the light to medium duty range. One to six spindles; 14", 20" or 26" swing; capacity of No. 2 Morse Taper.

PRODUCTION MEN
Get This Handy Slide Rule
A valuable aid in figuring costs and setting production schedules. Quickly gives time required to drill holes of any size and depth in any material. It's free. Write the nearest office.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

- CHICAGO 6, ILL. 565 W. Washington Blvd.
- DETROIT 26, MICH. 1533 Dime Bank Bldg.
- CLEVELAND 1, OHIO P. O. Box 5547
- NEWARK 2, N. J. Industrial Office Bldg.
- ROCHESTER 1, N.Y. Commerce Bldg.
- LOS ANGELES 14, CAL. 724 South Spring Street



Forming Machine Closes 4-In. Tube in 10 Sec.

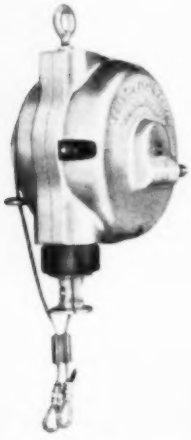
Equipped with removable dies, the Westin general-purpose machine is suitable for a variety of job applications. The forming cycle is fully automatic. For short runs of special work, however, manual operation is provided, controlled by means of a selector switch with separate push-buttons for control of the clutch chuck and turret initiation. A lever in this case controls the platen traverse.

Traverse speeds vary from 0 to 100 ipm, and the 8-step spindle speed ranges from 40 to 150 rpm. The three-segment die and three transformers permit equal loading of each phase of the conventional three-phase system, providing economical operation due to lighter electrical demand. The machine can be built for working tubing of almost any diameter or wall thickness. Brass, aluminum, copper, carbon steel, and most alloy steels including stainless, are being successfully worked by the Westin process, and other metals are expected to follow.

The Federal Machine and Welder Co., Warren, Ohio

has two hardened and ground power-driven feed-in rolls and ten straightener rolls, the lower five of which are also driven. The unit contains a mercury switch control arrangement and a 1½-hp drive motor. The combined straightener and coil take up very little more floor space than would be required for a power-driven cradle alone.

U. S. Tool Co. Inc., Ampere, N.J.



Tool Balancer Has 20-lb. Capacity

Developed to supplement the 10-lb. capacity balancer put out by the same company, this unit suspends tools weighing up to 20 lb. over the work area. Both balancers are designed to protect workers from fatigue, eliminate careless tool handling, and reduce loss or production time.

Keller Tool Co., Grand Haven, Mich.

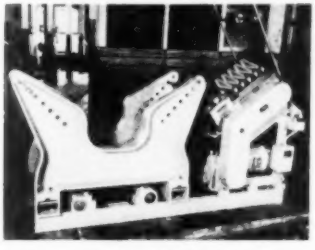
Three-Piece Bit Has Three Separate Cutting Edges

The Triple-Life Kennamatic router bit has three cutting edges of which only one is operative at a time. When this becomes dull the bit is turned so that another edge comes into cutting position. In this manner three indexes can be made before any sharpening is required.

Dull edges are ground with diamond dust and a suitable size drill rod, mounted in a drillpress or lapping machine. The bit is designed for routing soft and hard woods, plywoods, various types of fiber board, both hard and soft plastics, and type metal. If routing conditions require a starting hole, the bit can be used as a drill.

The Kennamatic router bit is now made in five sizes with cutting diameters ranging from ¼ to ½ in.

Kennametal Inc., Latrobe, Pa.



Coil Cradle Combined with Power Stock Straightener

The Model PDSC-1240 U.S. automatic power-driven coil cradle and stock straightener handles materials up to 12 in. in width, up to ⅛ in. in thickness, and coils up to a maximum OD of 40 in. The straightener

Flexible Abrasive Stick Polishes Metals

Used like an eraser, this fine-grain abrasive stick removes tool marks, scratches, or rust from copper, brass, bronze, iron, steel, aluminum, and other metals. Non-dusting, non-conducting, and non-loading, it is recommended for commutator and slip-ring maintenance and can be used while the motor or generator is in operation.

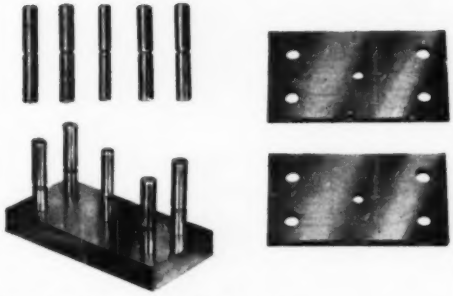
The Ideal Flexible Abrasive is made in five sizes from ⅜ to ½x5 in. to 1x4x5 in. It weighs approximately one oz per cu in.

Ideal Industries, Inc., Sycamore, Ill.

3 Hole Grinding Problems { CAN YOU ESTIMATE THE TIME?

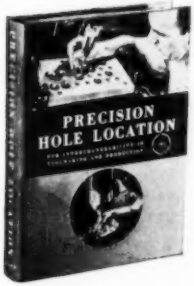
TWO-STATION DIE BLOCK

All holes ground to exact size and location. Blank hole and center piercing hole ground with one half degree included taper. Little clearance permissible between punch and die. 2¾ *hrs. on the Moore Jig Grinder.*



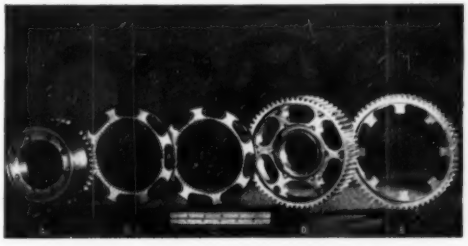
TEN HOLES IN MASTER PLATES

Hardening distortion corrected in two plates. Ground to size and location *independently* and to plug gage fit in any of the four possible positions. 3½ *hrs. on the Moore Jig Grinder.*



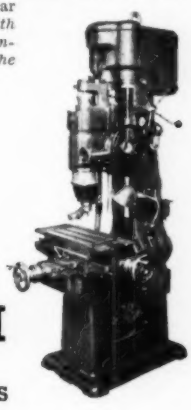
HAVE YOU BOUGHT YOUR COPY OF "PRECISION HOLE LOCATION"?

An entire chapter of this authoritative handbook on toolmaking practices is devoted to an engineered solution to the problem of correcting holes by Jig Grinding. Over 5,000 copies have been sold to date. Available at special price of $3 in U.S.A.; $3.50 outside U.S.A. 448 pages, over 400 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Send check or money order to Moore Special Tool Co., Inc., Bridgeport 7, Conn.



FIVE ACCESSORY GEARS IN MASS-PRODUCTION

Gear A: Eight holes on circle ground to size and location within ±.0006"...*Gears B, C, D, E:* Radii at ends of elongated pockets ground to size and location within ±.0003"...*Gears B, C:* Radii ground to shoulder near bottom of pocket within ±.0005". *With special indexing fixture, 4 aircraft engine gears per hour finished on the Moore Jig Grinder*



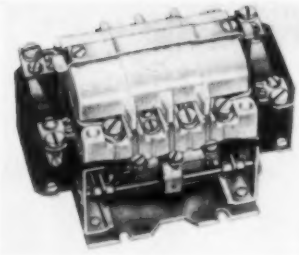
"Correcting Hole Location Within Less Than .0001" is the title of our new 28-page catalog which describes the operation and applications of the Moore Jig Grinder to dies, drill jigs, gage parts, master plates and production parts. Write for your copy today.

MOORE SPECIAL TOOL CO., INC. • 738 UNION AVENUE, BRIDGEPORT 7, CONN.

ADD (MOORE TOOLS) TO YOUR TOOLROOM

JIG BORERS JIG GRINDERS DIE FLIPPERS

PANTO-CRUSH WHEEL DRESSERS HOLE LOCATION ACCESSORIES



Thermosetting Resin Compound Houses Magnetic Starters

Plaskon Alkyd, a thermosetting industrial molding compound, is being used in molded bases and protective hoods for RA magnetic starters. Among its desirable electrical properties, this new compound is said to have high arc resistance, high solvent and chemical resistance, high abrasion resistances, and it does not support combustion. These properties are expected to permit installations of the magnetic starters in locations formerly considered impractical.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

Oakite Material Produces Dense Foam on Acid-Pickling Solution

This material, Oakite Composition No. 38, produces a dense foam on acid pickling solutions and effectively seals in evolved gases. It is stable in highly acidic solutions, and forms a dense foam blanket on nitric-hydrofluoric, hydrochloric, and sulphuric acid solutions to provide a seal against the escape of acid fumes.

Oakite Products, Inc., 124 Thames St., New York 6, N.Y.

Lab-Sized Electric Furnace Heats Continuously up to 1650 F

Designed for operation on 115 and 230 volts the Series 1500 bench-type Temco electric furnace can operate continuously from 350 to 1600 F and intermittently to 1900 F. The furnace is built in two chamber sizes: 4 in. wide, 3½ in. high and 4½ in. deep, and 4 in. wide, 3½ in. high and 9 in. deep. Heating elements are embedded in refractory plates forming the sides, top, and bottom of the heating chamber to insure even distribution of heat, protection against physical damage, and to minimize oxidation. Top and bottom plates are interchangeable as are the sides. Any plates can be replaced without dismantling the furnace. The door is uplifting and counter-balanced with a refractory offset, projecting into the chamber for an efficient heat seal. The instrument panel houses an indicating pyrometer calibrated in both Fahrenheit and Centigrade scales, a toggle switch, and neon signal light.

Thermo Electric Mfg. Co., 461 W. Locust St., Dubuque, Iowa.

HPL U-Expander Can Be Cut To Fit Any Diameter

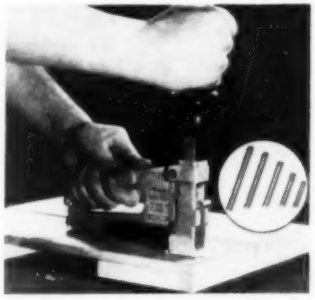
Produced in numerous heights of specially rolled brass strip material this metal spring expander is highly impervious to corrosion from brine solution, gasoline, alcohol or sea water. It is said to maintain uniform pressure on both the ram and inside wall of the recess.

HPL Mfg. Co., 2013 E. 65th St., Cleveland 13, Ohio

Coated Cotton Glove Resistant To Acid, Caustic Solvents

This coated cotton work glove, called the Ply-Garb, will not crack or peel and does not become slippery when immersed in oil, water, or solvents. It is said to be water, acid, caustic, and petroleum solvents proof. Large size, first-quality cotton gloves which meet Federal standard specifications for a 10-oz. work glove are used for a base.

The Milburn Co., 3246 E. Woodbridge St., Detroit 7, Mich.



Heller Portable Nailer Feeds Automatically

Precision built with tool-steel mechanism, the Heller Nailer drives through light metal, pressed wood, and into hard wood as readily as soft wood. The machine holds over 100 Heller lock nails at one time. Lock nails come in several sizes from 7/16 to 1½ in. long.

The Heller Co., 2135 Superior Ave., Cleveland 14, Ohio.

Lifting and Weighing Combined in Hydroscale

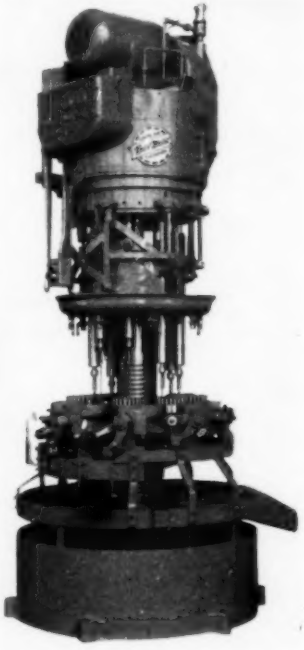
Hung from cranes and chain hoists the Hydroscale comes in 2-, 5-, and 10-ton models. Permanently sealed, without moving parts, and accurate within 0.5%, the Hydroscale automatically weighs loads during lifting operations.

Hydroweay Scales, Inc., 7632 Fenkell Ave., Detroit 21, Mich.

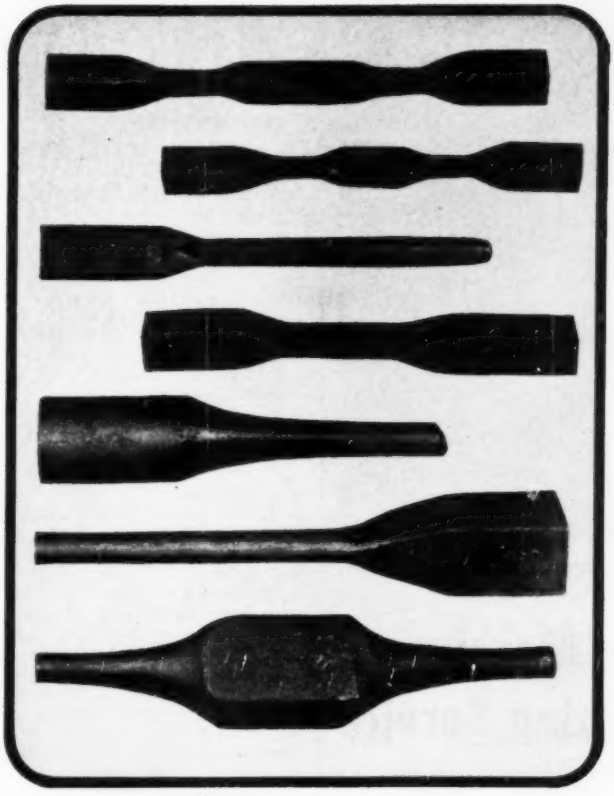
Di-Noc Universal Primer Adheres to Aluminum

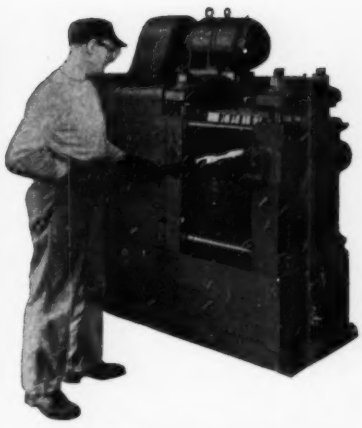
Prepared in both neutral gray and white, Di-Noc Metal N33 readily takes an overcoat of most regular finishes. It is said to have excellent adhesion to aluminum without special preparation and high abrasion resistant characteristics. It is priced at $3.85 per gal.

The Di-Noc Co., 1700 London Road, Cleveland, Ohio



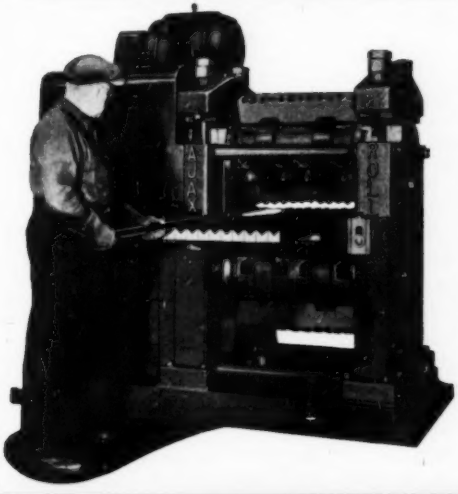
VERTICAL DRILLER is adapted for reaming two sizes of intake- and exhaust-valve guides, the larger of which is 3½ in. long and has a 5/16-in. hole. Fixturing and unloading are automatic. This machine has eight 20-station automatic indexing-type fixtures, and is capable of processing 2,500 pieces per hour.—*Davis and Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.*





AJAX ROLLS

For all sizes and types of FORGING BLANKS



Available in six sizes, AJAX Wide Adjustment Forging Rolls have capacities for pre-rolling forging blanks ranging from the smallest automobile valve rocker arm to the largest airplane propeller. And backing these, AJAX engineers have a priceless wealth of experience in design of roll grooves and pre-rolled forging blanks acquired during the more than fifty years since AJAX introduced these Rolls into the forge shop.

Die width to accommodate the considerable series of grooves required for abnormally great, cross-sectional reductions or several groups of grooves for blanks with different metal distribution, gives these machines wide general utility.

The advantages accruing in the press forging or drop forging of accurately proportioned, pre-rolled blanks through metal saving, longer die life, greater output and stronger forgings warrant your investigation.

WRITE FOR AJAX BULLETIN 91-A
And Additional Information

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST. CHICAGO 3, ILLINOIS
DEWART BUILDING NEW LONDON, CONN.

The metal box, upper left behind operator, contains electronic tracing device which follows sketch and guides cutting torch.

New Electric Eye Machines Speed Ryerson Cutting Service

The multiple-torch gas cutting machine shown above is one of eleven recently installed in Ryerson plants from coast to coast. Equipped with an electronic eye tracing device, these remarkable new machines cut the most intricate shapes swiftly, accurately. Time spent in preparing wood and metal templates is eliminated. Instead the electric eye follows a simple sketch or blueprint within plus or minus fifteen-thousandths of an inch!

With electric eye machines rounding out a complete flame-cutting service, your Ryerson plant produces an endless variety of shapes—cuts hundreds of pieces to the same pattern with almost die-cut uniformity, from steel plate up to 15-in. thick. The result: clean, accurate edges whether mild steel, high carbon, alloy or stainless steel is used.

The new Ryerson cutting machines illustrate how we are continually expanding our facilities to give you faster, more efficient steel service. The exact steel you need, cut or otherwise prepared to your particular specifications is delivered promptly when you draw on large, diversified Ryerson stocks.

Large Stocks of Carbon, Alloy and Stainless Steels
Also Metal Working Machinery & Tools

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK, BOSTON, PHILADELPHIA, DETROIT, CINCINNATI, CLEVELAND, PITTSBURGH, BUFFALO, CHICAGO, MILWAUKEE, ST. LOUIS, LOS ANGELES, SAN FRANCISCO.

ROUND TABLE Discussion

CAN ENGINEERS COME INTO THE SHOP?

Back in the decades gone by, in many shops the draftsman was looked upon as being a curse rather than a help to the production line. Those were the days when the rule of thumb was paramount and the procedure was more or less of a hit-and-miss proposition.

Today, all these relations are changed. The engineering divisions design the products and the shops produce them.

Now, in the case of Ed's seeing red, he is all wrong. He should welcome any suggestions by an engineer or a draftsman, provided he can't shoot holes in the latter's ideas. Changes in design are bound to come, for this is progress.

An engineer or a draftsman should have access to the shop when such visits are necessary. Many large firms encourage men from the engineering departments to follow their work through the shops. These men can, in many cases, see a blister coming before the shop man may realize that continuance in the direction he has started is a detriment.

In a certain shop, a machine had been partly built when all work was stopped. Nobody in the shop knew why, until one of the men from the planning division, an engineer, came and checked all of the work which had been done; then, a new set of drawings was sent to the shop and all conjectures of the men in the production department tapered off. However, all of the men who had worked on this machine were disgusted because of the holdup until they learned that all of the cams (68 of them) on this unit had been changed by the engineering department in order to reduce the amount of power which would be required to operate the machine. Here is the result: The engineering unit had figured that 22 hp would be necessary to run the machine without any material in it and that by redesigning the cams, this would be lessened to 10 hp.

At a later date and upon a running test, the machine pulled 9.6-hp. There were several men from the engineering division as well as men from the production departments in attendance during the trial run. This event changed the attitude of the

KENT-OWENS BUILDS 'EM

RUGGED

TO KEEP YOUR PRODUCTION UP AND COSTS DOWN!

Maybe we're "sticking our neck out"—but we think your toughest milling problems can be handled *right* with Kent-Owens Machines!

On countless jobs—these Milling Machines have shown ability to turn out the work with top speed and high accuracy. They're outstandingly rugged . . . efficient . . . dependable. Designed with practical features that help you *produce more* . . . with *lower costs!* The Kent-Owens Standard line includes a wide range of hydraulic and hand operated machines. Let Kent-Owens engineers recommend machines and tooling best suited to your requirements. Write us about your needs. Kent-Owens Machine Company, Toledo, Ohio.

KENT-OWENS *Milling Machines*

KENT-OWENS REPRESENTATIVES

BOSTON — General Machinery Corp.
BUFFALO — Don W. Patterson
CHICAGO — Noll, Kohlbusch & Bissell
DALLAS — Hamilton-Hunter Mach'y Co.
DAYTON — Geiger Mach'y Company
DETROIT — A.C. Haberkorn Mach'y Co.
GRAND RAPIDS — Joseph Monahan
HOUSTON — Oliver H. Van Horn Co., Inc.
INDIANAPOLIS — Oasis Machinery Co.
KANSAS CITY — Eichman Machinery Co.
LOS ANGELES — Eccles & Goeman Mach'y Co.
MILWAUKEE — Noll, Kohlbusch & Bissell
MINNEAPOLIS — The Saunders Company
MOLINE — John J. Normoyle Co.
MONTREAL — F. P. Barber Mach'y Co.
NEW ORLEANS — Oliver H. Van Horn Co., Inc.
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PHILADELPHIA — Colco Machinery Company
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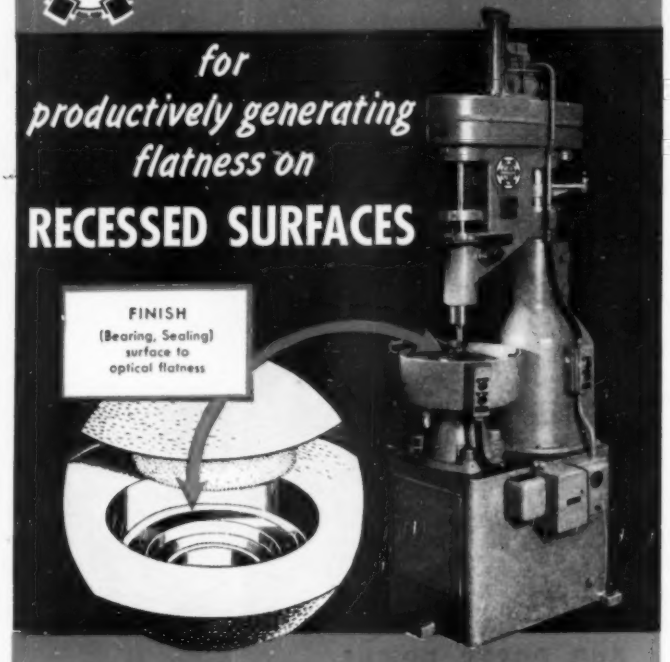
ROCHESTER — F. W. Schiefer Machinery Co.
SAN FRANCISCO — C. F. Bulotti Machinery Co.
ST. LOUIS — Blackman & Noetzel Mach'y Co. Clarke Equipment Company
SYRACUSE — J. F. Owens Mach'y Company
TORONTO — F. P. Barber Mach'y Company
WALKERVILLE — F. P. Barber Mach'y Company

MICRO MATIC

MICROFLAT

for productively generating flatness on

RECESSED SURFACES



● Microflat machines may be equipped to finish recessed surfaces.

The location of a surface does not limit the application of the MICROFLAT machines. Any surface that can be machined can be finished with this equipment. The surface finish and flatness generated can be controlled and held to any specified requirement.

The machine shown above is equipped with a timer and an air cylinder. The operator loads the part into the fixture and starts the cycle. The fixture rotates, the bonded abrasive finishing surface oscillates and rotates. At the end of a predetermined time cycle the spindle automatically withdraws. Production is 300 pieces per hour.

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE, DETROIT 4, MICHIGAN

DISTRICT FIELD OFFICES:

3323 S. Santa Fe
Los Angeles 21
California

416 Empire Bldg.
206 S. Main St.
Rockford, Ill.

55 George St.
Brantford, Ont.
Canada

Maxwald Manufacturing Co.
Boston Post Road
Guilford, Conn.

whole organization, for all were interested and impressed by the calculations of the engineers.

But, to return to our case, Ed's obtuseness towards having a man from another department enter his domain is both narrow and wrong. He should invite any and all constructive criticism and should realize that he does not know it all.

As to the idea that he cannot control costs or output, an instance came up several years ago. There was some discussion about several jigs and fixtures and their efficiency when a member of the shop crew made the assertion that one of the jigs he was using could be greatly improved. The cost of the change was rather alarming, but after a consultation with one of the engineers it was done by making a new jig. The operating efficiency of the workman was an advantage for he could produce slightly better than 11% over his old rate, and as he was on piecework, both the firm and the man were benefited. It might not have been so easy to convince those in power to spend the money, but a bottleneck was there at that point.

A former acquaintance, a man of better-than-average ability, became a foreman and he proved to be a real one. He would assign the jobs and if there was any doubt in his mind about any workman's ability to do the work given him, he inquired as to the latter's ideas and intentions in regard to the necessary operations. In this way, he learned where the man lacked in ability or experience, and so could make suggestions as to how he thought improvements could be made upon the ideas of the workman. He was always square in his treatment of men and their shortcomings.

Undoubtedly, Ed can follow drawings, also he is interested in keeping his end up in the matter of producing and the reduction of costs but he should relieve himself of the petty details which are bound to flare up every day, and he should not be averse to cooperation with an engineer or a draftsman because good ones know their business, and each can learn from the other.

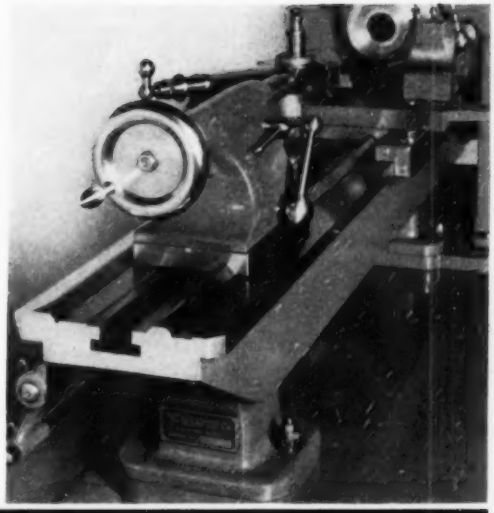
F. H. Stebbins
Worcester, N. Y.

•

TEN CENTS A CHANCE

There is no harm done in this kind of pastime (petty gambling), if it does not interfere with the workings of the shop and is accepted by all who take part in it. The question comes up about the soul who doesn't win one of the prizes and cries aloud

THE Wade NO. 8A HAS A BED WITH AN AMPLE FRONT GUIDEWAY



Broad, heavy . . . this rugged construction assures maximum strength and rigidity. Enables you to take heavier cuts and produce finer finishes, *free of chatter.*

. . . another *exclusive feature* of the Wade No. 8A TOOLMAKER'S PRECISION LATHE

Check this bed against the bed on any other lathe of similar size and capacity! Note its design, which places the guideways directly over the supporting sides of the bed, locates the front guideway *close* to the point of application of power and to the point of pressure on the work. Bearing surfaces like these are ordinarily found *only on much larger lathes!*

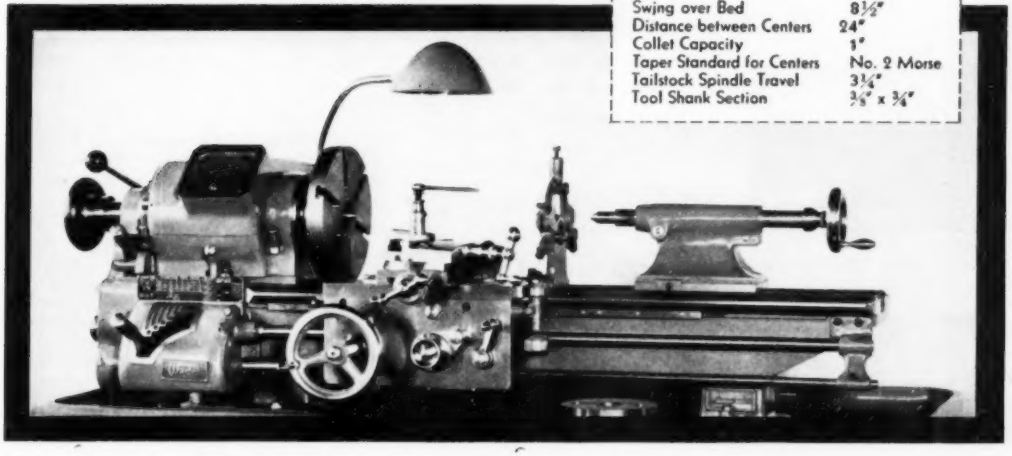
The bed is available with ways either hardened and ground or hand-scraped and spotted. Material is a close-grained alloy cast iron — a special formula worthy of the fine lathe of which this bed is the very foundation.

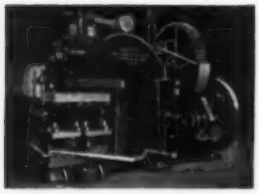
Our circular describes other important new features: the variable speed drive with electric tachometer; rear station tool block on the compound cross slide; thread-lock spindle nose; full-bearing tailstock; complete electrical system, with reversible starter. *Send today* for the "No. 8A Bulletin"!

THE WADE TOOL CO. 53 River St., Waltham 54, Mass.

SPECIFICATIONS

Swing over Bed	8½"
Distance between Centers	24"
Collet Capacity	1"
Taper Standard for Centers	No. 2 Morse
Tailstock Spindle Travel	3¼"
Tool Shank Section	⅝" x ¾"





BEATTY No. 11-B Heavy Duty Punch widely used in railroad industry.

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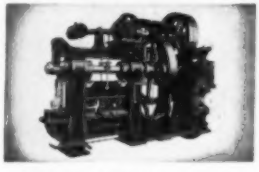

BEATTY CoPunShear, one unit does coping, punching, shearing.

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HYDRAULIC PLATE METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
HAMMOND, INDIANA

that it's a gyp. There will always be at least one of these in any bunch, no matter how small, and his voice has to be overlooked. If it is a case of swindling, the men would soon enough find out, and the seller would be poorer for his lack of friendship and companionship.

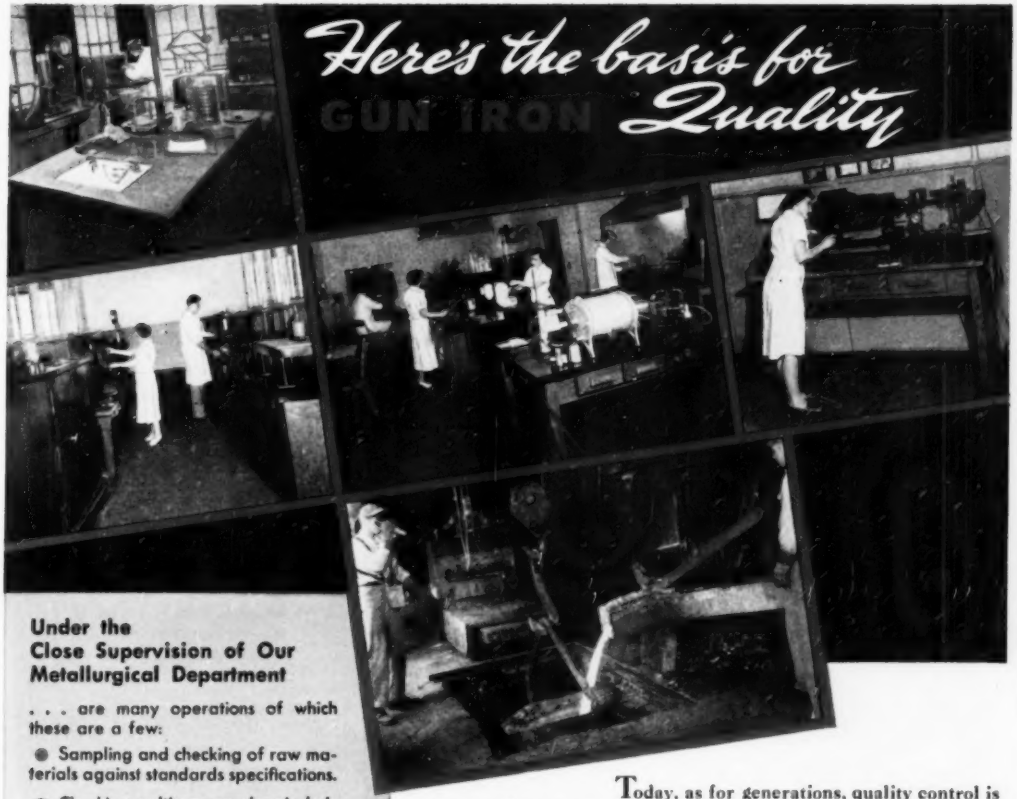
In my shop there are always small-time raffles, baseball pools, matching to see who paid for the soft drinks, etc. This all takes place in the few minutes that everyone spends gabbing, and would be lost time any way you put it. Every American has some inclination towards gambling, no matter how petty, and I believe that this form of the art prevents the urge from becoming too big to handle. As Al says, it's strictly a business proposition with the men in his shop. Even if it isn't strictly business, the guys get a little fun out of it, and a gang that can play and have fun, now and then, is a good bunch to work with. The saying, "all work and no play" is still a good one, no matter how old, and this is one form of the word "play."

In a case as cited in the discussion pages, why shouldn't the fellow be allowed to part with his wares among men who know their value, instead of having to take whatever is offered him through some second-hand dealer. Not only does he regain some of what he has put out for the tools, but some fellow, with a good eye for value, is able to pick up some valuable equipment at a price he can afford.

In almost every case, if the party is one of the workers that I am acquainted with, most of the time spent on selling would be during the noon hour, or after shift hours. Most men I know, treated like human beings on the job, do their best for the old man, and have the interest of the job at heart. There are those who spend their entire lifetime working to get out of work, but why not let them do a little honest buying? They'll kill the time somehow.

I don't believe that the shop raffles should be suppressed. It would only tend to make the employee think the boss is prying too much into his private life. If the foreman in charge is a good man, with the proper background, he can see at a glance if the deal is on the up and up. It is when these deals are carried on "in the dark" that there is the danger of someone getting hurt. I say let them come out in the open and hold their little market day, but not to jeopardize their liberty with too much company time.

Jack Bell
Bakersfield, Calif.



Under the Close Supervision of Our Metallurgical Department

. . . are many operations of which these are a few:

- Sampling and checking of raw materials against standards specifications.
- Checking melting procedure including initial furnace efficiency and specification of mixture.
- Checking representative metal samples by standard foundry procedures supplemented by rapid chemical analysis prior to furnace tapping.
- Checking maintenance of temperature controls at tapping and pouring.
- Making continual analysis of sand.
- Supervising Gamma-Ray inspection of castings.
- Specifying and checking heat treat procedure and making physical and metallographic tests.

Today, as for generations, quality control is of utmost importance in Hunt-Spiller operations. Illustrated above are the modern Hunt-Spiller laboratories each of which is staffed by highly capable metallurgical technicians. Here are complete facilities for chemical analysis, physical testing and metallography.

However the responsibilities of the Metallurgical Department extend beyond laboratory control alone. In various production activities such as the checking of melting procedure, inspection of castings, establishing of heat treating methods and other operations, Hunt-Spiller metallurgists are constantly on the job.

That is why Gun Iron is always uniform in structure, strength and hardness and is unexcelled for resistance to heat, wear and distortion. That is why Gun Iron castings are produced without defects and have the physical properties which assure consistent machineability to even the closest specified tolerances.

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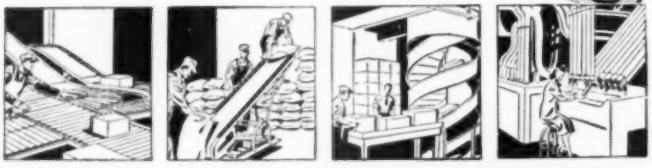


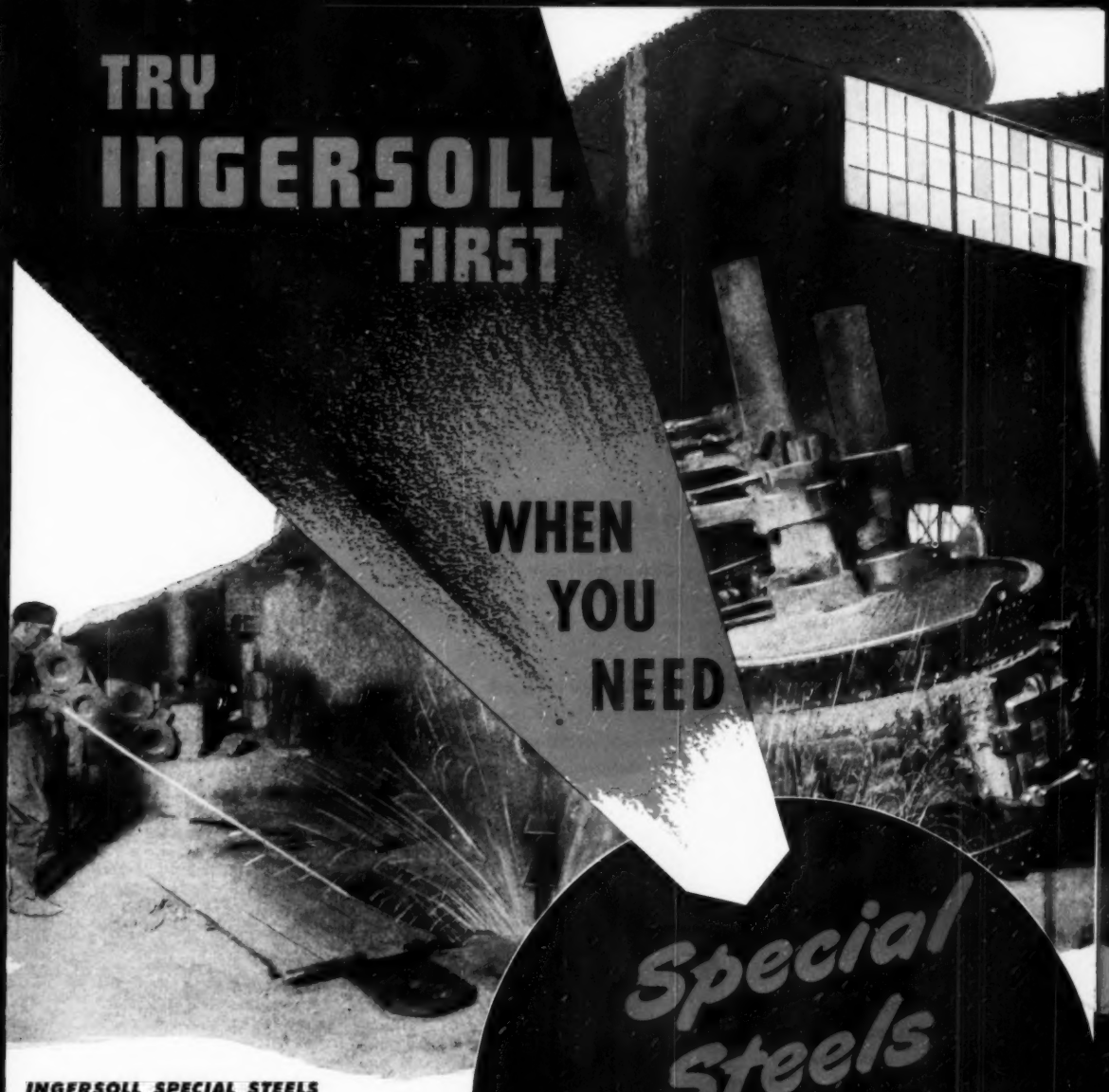
ROLLER - BELT - SLAT - CHAIN CONVEYORS • PORTABLE CONVEYORS AND PILERS • SPIRAL CHUTES • PNEUMATIC TUBE SYSTEMS

If Pat's in a jam, there's no reason why the whole shop should be messed up as a consequence. Raffles are all right for those who have the gambling instinct, but I have seen a few crooked deals pulled off in connection with them that makes me feel very much opposed to their practice. As for holding them in the shop, I draw the line. If raffles are condoned, the first thing you know one of the men will be putting one of these steaming hot-dog contraptions on his bench. Then as his fellow workmate sees the growing business nearby, he will soon be stoking his bed of hot charcoal beneath a tray of irresistible brown chestnuts. What man wants to have the shop resemble the midway of a carnival?

It would be rather annoying, don't you agree, for the poor boss to have to struggle with his many tough problems while his shop is resounding with something like this: "Come on boys, get 'em while they're hot—hurry, hurry, hurry and crunch down a nice, juicy dog while that long cut is going on." Beastly American habit, what! Let us keep the dignity of the shop to its highest in efficient production and put the taboo on such performances. It seems that I have been blessed with a good memory in being able to recall some things that happened in the far distant past. I call to mind one particular raffle held when I was employed at the Non-twisting Shoelace Machine Manufacturing Company back in the smoke-laden suburbs of old Pitt. An old gent, who prided himself in looking after Number One, put up an organ as the prize. Now an organ in the old days was a luxury around which the metal-busters congregated to relieve their burning consciousness by singing praises to their lofty executive. Old Tom had enough tickets printed for this raffle to stuff the organ to its limit and what the old lathehand collected from the gullible ones must have been enough to purchase the pipe organ in the Uplift Trinity church on the outskirts of town. When the drawing was held one evening many weeks following the sale of the first ticket it was not one of the shop men who held the winning number. The lucky holder turned out to be one of old Tom's friends who lived about 500 miles away!

Yes, to me raffles are not to be trusted and should not be tolerated. Such things as raffles, hot-dog stands, chestnut roasters, and gadgets with whistles going full blast while peanuts turn around inside are decidedly time-consuming outlaws and nothing short of distracting headaches for the foreman of the

TRY INGERSOLL FIRST



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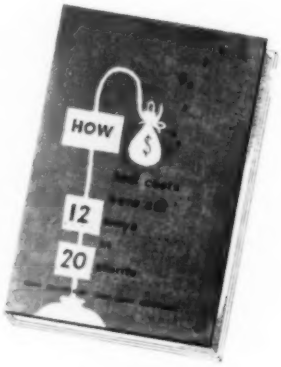

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shop. Besides, who'n the heck wants a second-hand micrometer anyhow?

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•

TEN O'CLOCK SCHOLAR

"A diller, a dollar, a ten o'clock scholar," is the way the nursery rhyme went—to the best of recollection. While few of us know the meaning or connection of the "diller" and "scholar" part, the "dollar" is one word even the most obtuse can understand. The problem for many industries is to make this understanding of tardiness and "dollar" so proximate that they will assume a relationship like "ham" and "eggs."

The importance of making this synonimity clear is twofold. First, touching of his pocketbook awakens a reaction in even the most lackadaisical of workers and generally in an inverse ratio to the amount of money he justly earns. That is to say, those who make the loudest squawks about increases, standards, or "cuts" are for the most part workers whose labor output is the lowest and whose response to reasoning and appeals for community-of-the-shop thinking is negative.

Secondly, an individual's tardiness not only reduces his opportunity for peak earnings in that period but it throws an economic drag on his fellow-workers and the proprietorship. The latecomer has a place in the boat, but while he is going along for the ride, he also must pull an oar. Now if he misses the boat someone must be found to take his place, or others must not only shift to balance the load but work harder to carry it. This takes time for the foreman and productive time from the rest of the workers. Then, when and if he turns up, as a latecomer, the whole scene must be shifted back, more time and money are lost.

One very large automotive company used to have a ruling (perhaps still does) that tardy workers could not assume their regular places but were assigned to the "pool" from where they were sent out to fill vacancies of other delinquents such as themselves. As their time in the "pool" was day rate and they needs must "learn" a new task on the temporary job their day's pay shrank considerably though they were obliged to work as hard or harder as in their regular job. This rather successfully punished the misdemeanor without giving the recipient an opportunity to sulk or slowdown except at his own cost.

Many companies close all en-

Here's what one cost-conscious plant achieved by using ANTISEP A.P. BASE*

1 Coolant cost reduced from 50 cents to 22 cents per finished assembled unit.

2 Cutting fluids reduced from over 40 varieties to 4.

3 Tool life doubled over former machining practice.

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The reason lies in the amazing properties built into Antisep A. P. Base. It's sulphurized, it's antiseptic, it's high in film strength, it pleases operators, it saves money. Imagine a cutting fluid for 6¢ a gallon diluted cost!

You, too, can get better machining at lower cost by switching to Antisep. Ask Houghton to prove it. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

P. S.—The above manufacturer also uses Houghton's heat-treating salts, metal cleaners and rust preventives. He's saving there, too.

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any man in your shop can produce precision

1 SPUR GEARS

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up to and including 45°, right or left hand

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CAPACITY—13" diameter up to 16" of face and 4 diametral pitch in steel, in one cut.

FEATURES—The Lees-Bradner patented hob in-out mechanism; rapid traverse differential; and, if desired, the Lees-Bradner lead differential technique.

ONE MAN CAN HANDLE SEVERAL MACHINES!

Write for Bulletin 61-A

The LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

trances to the plant, but one, immediately the starting signal sounds or after a grace period of say three minutes, if allowed. This other gate through which all now must pass is usually that near the general superintendent's office or that of the personnel department. The latter is to be preferred inasmuch as the "super" has the whole plant to consider and will have more pressing problems at the start of the work period. On the other hand the function of the personnel department being to deal directly with employee's records, every facility will be handy to note the lateness on the workman's "case history."

Depending upon the methods used within the plant the value of the notes on the employee's personal record could be brought into play. Experience would soon teach the personnel department just how many "lates" constitute an average. Over this amount each violation warranting a demerit should be taken into consideration at the time of periodic wage increase reviews. Too, there is no unfair reason why, other things being equal, such demerits could not be placed on the seniority balance at the time of layoffs.

While it is not completely agreed with the contention of some that punctuality should be rewarded by bonus, since the arrival at work regularly and "on time" is part of every employee's contract when first hired, there is the fact that human averages are to be considered. If an employee is the type who rises earlier on stormy mornings to allow for contingencies that might delay his arrival, some reward other than those generally attributed to "virtue" should be forthcoming for his habitually good record above the plant average. It should not require too much weighty consideration, nor lay any personnel policy open to attack to provide for this, say by means of additional days of vacation for each six months of "merit" marks, or a few cents more an hour over the average labor grade pay scale into which the worker falls. This is, of course, in addition to the effect on seniority.

Then to swing to the other end of the scale, care must be taken in the application of demerits and too strict fines for tardiness, as continuous abuse by the worker could crowd the seniority rating and wage increase factors to a point of no return where the offending employee realizes he has nothing to lose by being late, and having lost interest or enthusiasm because some of the suc-

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Now, stainless steels in all standard joint designs, in thicknesses of ⅛ inch plus, can be welded faster *in all positions.*

You can make single or multi-layer welds by either beading or weaving. Vertical welds can be made upward or downward. In short, the Aircomatic Process permits the welding of stainless with all the ease and versatility of ordinary steels — at a high rate of deposition and with complete freedom from slag.

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cess incentive is gone, albeit from his own fault, he soon turns partial tardiness into complete absenteeism.

Where incentive or piecework pay systems are used, the application of a "lateness multiplier" to that particular day's bonus payment might be installed with a fair measure of success either in addition to any or all of the above, or better still by itself. The reason for the latter being that were the "multiplier" based on the number of minutes late, beyond a three minute period of grace, the delinquent still has an incentive to cut his tardiness to a minimum and has really more reason to work harder to make up the difference between his usual daily bonus and the one he would earn under a "lateness multiplier" penalty. The punishment is immediate, geared to the offence and can by careful mathematical compilation of the "multiplier" extend the point of diminishing returns to the maximum. By being over and done with on the "late" day it gives the worker every encouragement to carry on with an unblemished record, knowing however unconsciously, that though "tardy" may mean "slow," "reluctant" in a dictionary sense, no such blot appears on his personal record.

A. M. Elliott
LeRoy, N. Y.

•

There is at least one in every shop—the perennial laggard, with a bookful of alibis and usually a smugness which increases in proportion to the number of times that he seems to get away with his lame excuses. There is the stock attitude of the offender which seems to say—"it's money out of my pocket, so why should the boss mind?" Well the boss does mind and justly so—usually the laggard is not dependable and production schedules are based upon a reasonable assumption that the men can be depended upon to start work on time.

We have had experience with perennial laggards and after listening to lame excuses we decided to use the following method in dealing with the stragglers:

We overlooked the first and second offense with the usual docking for the time lost. On the third offense, the man is called into the office and has explained to him, by his foreman or the shop superintendent, just how important it is that the men all start at the same time and because we noticed that he is having difficulty in getting to work

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Cross Universal Gear Machines embody advanced engineering developments to obtain highest productivity and assure lowest possible operating costs.

They feature utmost flexibility for handling a wide variety of gears. Continuous cutting motion, exclusive with Cross, speeds production at top efficiency.

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No. 55

For rounding, pointing, chamfering or burring external and internal:

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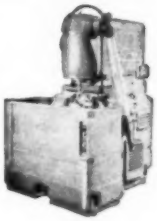
helical gears
clutches
splines

Typical productivity when rounding or pointing 8 pitch 30 tooth gears is 55 net hourly.



No. 65

For pointing or chamfering external and internal:

clutches
spur gears
bevel gears
splines

Typical productivity when pointing 10 pitch 30 tooth gears is 100 net hourly.

No. 75

For burring or chamfering both ends at the same time.

helical gears
spiral bevel pinions
hypoid pinions

Typical productivity when chamfering 8 pitch 40 tooth gears is 200 net hourly.

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For years you've seen snap gages — both with and without Indicators — that really do *not* answer your needs. You've wanted a simple gage that was foolproof, rugged, and easy to handle — *and at a right price.* Here it is: Federal Model 1000! All our research, all our know-how in gage-making, all your wants, likes and dislikes, your demands and your gripes have been carefully considered to make this an outstanding Gage. Model 1000 is "IT", the right gage at the right price.

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MODEL 1000 SERIES

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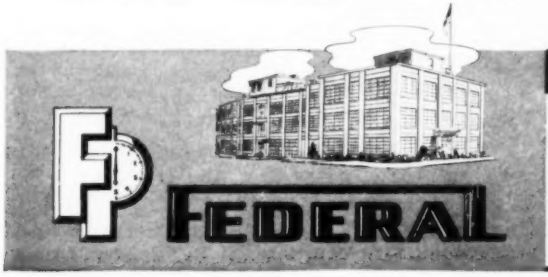


SEND THIS COUPON TODAY

FEDERAL PRODUCTS CORP.
1102 J Eddy St., Providence 1, R. I.
Please send me complete information on the new Model 1000 Series Snap Gage:

Name ..... Title .....

Company .....

Address .....

Those who use small, precision gears as component parts of their completed assemblies can profit by the convenience and economy of producing them on the Hamilton No. 1 Precision Gear Hobber.

Built to extra close tolerances, the Hamilton No. 1 is designed also for super-rigidity to provide *lasting* precision under heavy loads. Hobs spur, spiral, and bevel gears, gear sectors, splined shafts, pinions, and worm gears of fine-watch precision and on high production schedules.

Speed, feed and indexing can each be set independently of the others. This feature, plus the wide range of Hob Spindle speeds (109 to 1259 R.P.M.), provides the machine with extra versatility; cuts set-up time far below previously acknowledged minimums and permits easy adjustment of speed and feed to the requirements of material being worked or gear size being hobbed.

The ideal Gear Hobber for use in shops where set-ups are frequent or in shops where runs are long.

For full information write for our new Bulletin H 1-49.

THE *Hamilton* TOOL COMPANY
810 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

on time, we feel that perhaps we could change the starting time to suit his particular needs. We ask him if he'd expect us to do that. If he answers "No" then we tell him firmly that we expect him to get started on time with the rest of the men or else we'll have to make a replacement—on the other hand if he says that the starting time is too early to suit him, we tell him that he can arrange to report for work an hour later each day and quit at the usual time thus losing himself one hour's pay per day. This proposition is put to the man in a firm manner—"We mean it, mister—no fooling"—the prospect of a five-hour weekly time loss usually brings about a reformation and some of our ex-laggards are now among the early birds.

Henry George
Dayton, Ohio

•

Any person may be late at work and have a reasonable excuse for it in rare instances, but when lateness occurs frequently it is invariably due to the man's carelessness.

It is quite noticeable that such careless ones get to a railroad station in time to catch the desired train or at the dock in time for the boat that they wish to board.

Why is he late to work? Just because he can get away with it. He should be told just how important his lateness is to his employer in very plain language.

In case his ability is exceptional, as in the case cited, he should be informed that because his ability is exceptional it is all the more important that he be on time. However valuable he may be to his employer, he certainly is of no use whatsoever when he is not there at a time when his skill is required.

The foreman in such cases is the only one who really knows how much disturbance such cases produce and his patience is certainly going to wear out sooner or later.

H. B. Martin
Watervliet, N. Y.

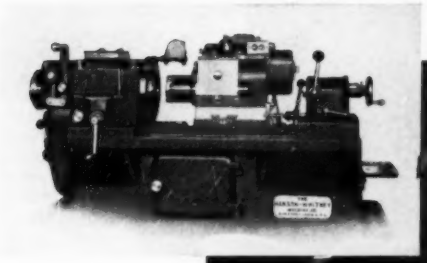
•

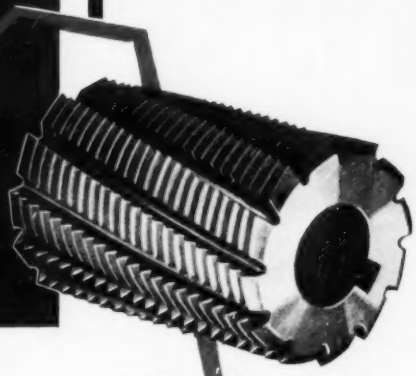
Very few big shops tolerate this perennial late-comer-to-work in this age. However, we do meet with him in the smaller shops where he generally is a nuisance in more ways than one.

Docking him for his time lost is really no good. I have seen him take to the notion that because he was docked, the firm was out nothing and he would continue his habit. Looking at it from the company

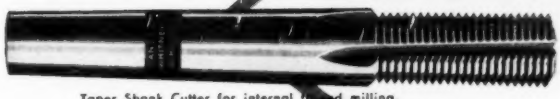
STOP COSTLY SPOILAGE

use Hanson-Whitney multiple thread Milling Cutters

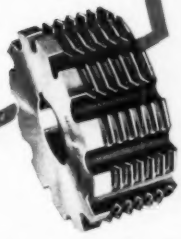




Shell Type Cutter for external thread milling, Thread Rolling Dies, etc.



Taper Shank Cutter for internal thread milling.



Shell Type Cutter for short external threads.

H-W Ground Multiple Thread Milling Cutters are finished all over, AFTER hardening, to the closest of limits.

Angle of thread, relief and spacing of threads are very accurately controlled. Teeth can be spaced minus or plus to compensate for hardening variations in the product... a valuable feature on Cutters for Milling Thread Rolling Dies, as teeth can be spaced minus, to compensate for Helix Angle of thread.

Used in combination with H-W Thread Millers, H-W Cutters will give you 100% perfect threads on a production basis... without COSTLY SPOILAGE.

If you're having threading problems... here's the solution.

HANSON-WHITNEY MACHINE CO., HARTFORD 1, CONN.

Division of Whitney-Hanson Industries, Inc.

For practical recommendations submit your problems to Hanson-Whitney engineers.

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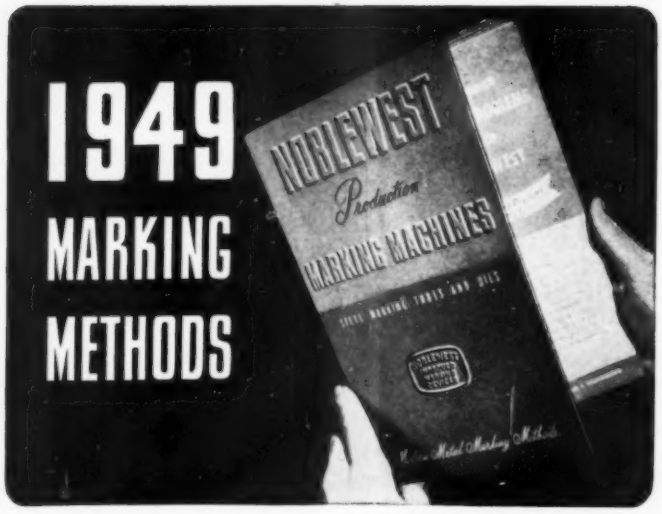
PIONEERS OF FINISHED TAPS

4HW49



One way to lower production costs

The new Noblewest rapid precision marking machines are stepping up production and saving money for leading manufacturers in many fields. Users of Noblewest equipment report increases up to 500% in marking speeds with fewer operators. The inscription, being permanently *rolled in*, lasts as long as the product itself. Every Noblewest marking machine is *engineered to meet your specific requirements* — and backed by the skill, experience and facilities of the world's largest manufacturer of Rapid Production Marking Equipment. You can put your marking problems up to Noblewest engineers without any obligation. A copy of our new catalog will be sent upon request. Write to Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

EQUIPMENT FOR MARKING · GRADUATING · EMBOSSING · NUMBERING

profit-and-loss basis, this man is no asset and should be replaced as soon as possible. Suppose this man is late only three minutes twice a week. That is one-tenth hour per week. In a year he has destroyed three hours time on a firm's output.

Now say 100 men do this in a year and you have 300 hours lost on the machine time or what ever the employees work at. When it comes to the timekeeper, this man creates special fractional figuring. Whereas if he could put in his regular 40 hr at hourly rate the timekeeper can carry his weekly figure in much less time. So you see this perennial late man messes up shop morale, company profit, and timekeepers' figures.

We can expect some variation from the rule. There may be a man who may live in an interurban area who owns a nice home he would like to keep and he is hampered by a bus or train schedule. We can make allowance for this type with very little trouble and loss of morale. However, he will cause a loss in my view so the individual shop must pass on his value to continue such a practice. This brings to mind two cases of this late type that were fired for this habit. I saw the one fellow come out of it so well he became superintendent of the next plant in a few years and he was really hard on his lates because he had been there himself. About three years after the second one had been let out, I asked the employer how he was doing and he said the man was never late. So there you are.

We have to use careful judgment on this question in emergency cases and it is not to be confused with the perennial. You can have the alarm clock act up—bus or train late—auto act up—sickness—or sometimes the better half can be out of sorts, and some can raise hob with your man's schedule and temperament. These cases deserve careful consideration, and sympathy sometimes.

Henry Rasmussen
Niagara Falls, N. Y.

•

THE ITCH TO TRAVEL

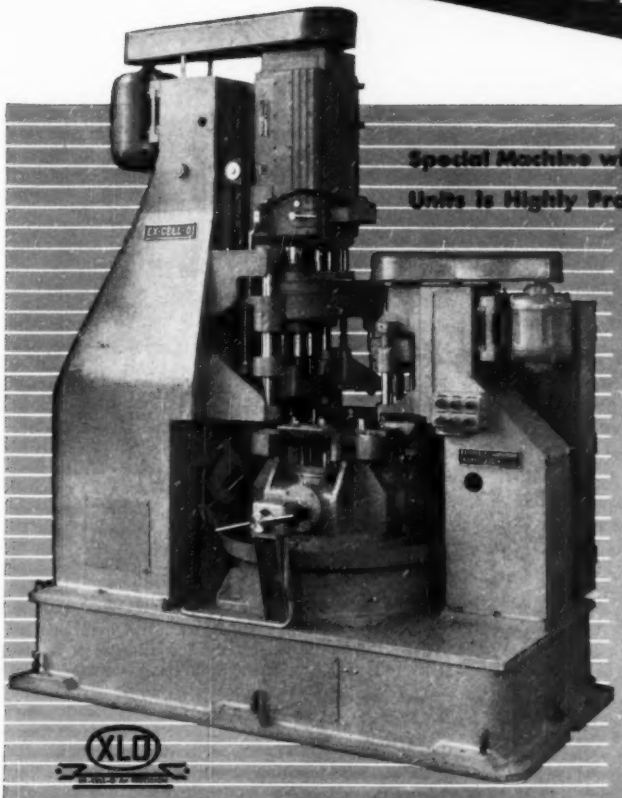
The itch to travel is more prevalent among the younger group, and it has many points in its favor which lead to education and progress and make them feel that each day should bring them some advantage in experience, step by step fitting them better to keep up with improvements that are overlooked by the careless.

It is only natural for the ideal em-

WANT TO

CUT COSTS?

See EX-CELL-O



Special Machine with Ex-Cell-O "Package" Power Units is Highly Productive . . . Low in First Cost!

Ex-Cell-O machines for combined operations save floor space, save handling, save man-hours. When Ex-Cell-O's standard hydraulic power units are used for feeding and rotating the cutting tools, the first cost is low. The Ex-Cell-O special machine shown to the left drills nine holes, reams one hole, and taps three holes in cast iron water pump body at a net rate of two parts per minute! If your production involves operations like this, get in touch with Ex-Cell-O in Detroit today!

49-7

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Special Multiple Way-Type Precision Boring Machines • Special Multiple Precision Drilling Machines • Precision Boring, Turning, and Facing Machines and Fixtures • Precision Cylinder Boring Machines • Precision Thread Grinding Machines • Precision Lapping Machines • Precision Broach Sharpening Machines • Other Special Purpose Machines • Tool Grinders • Continental Cutting Tools • Broaches and Broach Fixtures • Counterbore Sets • Grinding Spindles Hydraulic Power Units • Drill Jig Bushings • R.R. Pins and Bushings • Fuel Injection Equipment • Dairy Equipment • Aircraft and Miscellaneous Production Parts

OUR specialty is making tools to customers' specifications. If you're a user of Heald or Ex-Cell-O Precision Boring Machines, we can help you make BIG SAVINGS over your present expenses for replacements in boring, facing and chamfering tools, because all our production facilities and long experience are concentrated on producing at lowest possible cost. And we pass this lower cost on to our customers. Furthermore we have confined our efforts to a comparatively narrow range of tools which enables us to apply the most advanced cost-cutting methods to our production.

Send for our latest price list today. Compare our prices with those you've been paying and you'll appreciate the real value of the service we can render. Our service covers carbide boring tools in a wide range of diameters in any required length. You do not pay a premium for the particular shape you need because all our prices are based on stock diameters. Send blueprints of the tools you require and let us quote.

INDUSTRIAL CARBIDE TOOL CO., Inc.
23 Harrison Street WORCESTER 8, MASS.

ployee to be on the lookout for a better class of work to do—either in the shop where he is now employed or with some other organization.

In such cases, I have no criticism whatever if at a later date this man finds it to his advantage to take a job again with his former employer —which shows a reasonable chance to be desirable to both employer and employee.

An ambitious man is usually restless and anxious to better his condition and it is quite the natural thing for him to be on the lookout for something better either in the shop where he is located or with another organization.

I can see no just reason for an employer to interfere with such a procedure.

On the other hand, the man who is of a restless disposition and is constantly seeking a change just for the sake of making a change is an entirely different matter and has very little to offer to anyone to employ him and certainly nothing whatever where he may be seeking employment.

John Mark May
Watervliet, N.Y

•

It is very true that this roaming instinct that makes men periodically seek new jobs is a headache to personnel men and foremen. Somehow it seems that the ingrate always leaves just at the wrong time, without any consideration for anyone but himself. Invariably the departure occurs just when the man is most badly needed, causing the boss to scream condemnation on the itching foot of the miscreant.

On the contrary, we who stay in our jobs often become so engrossed in them that we fail to see the overall picture. We become mentally near-sighted, while the man who has "been around" has a fund of related experiences to use as a bank from which to draw ideas when something new to us stay-at-homes comes along.

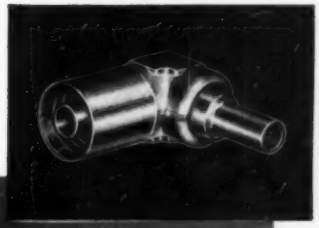
That is why the man with the itching sole always leaves "just when he was needed most." And strangely enough, bad times or good, he always seems to find a job, or to come back if he so desires.

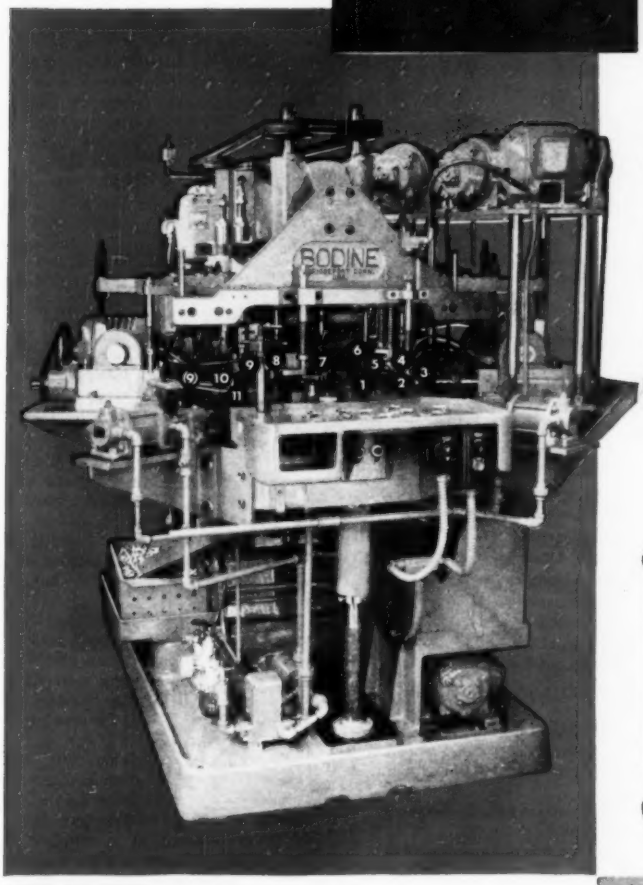
Conceding, then, that the man with experience in many shops has a broader range of know-how—that he is more likely to be able to use a trick or two to your advantage, what about the mental attitude of this vanishing machine-shop bum?

Usually he will have a less-jaundiced opinion of the man who buys

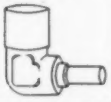
Bodine CASE HISTORY NO. 25

Processing a Forged Brass Tube Connector





1. Hand load forging to clamping fixture dial.
2. Center forging in fixture, automatically clamp (air cyl.).



3. Hollow mill two diameters, face & center end — Horiz. Drill Spdl.

4. Face large end, chamfer & spot drill — Vert. Drill Spdl. Drill .176 dia. hole to half depth — Horiz. Drill Spdl.

5. Trepan to 1/2" depth - Vert. Drill Spdl. Drill .176 dia. hole to 1-3/16" depth — Horiz. Drill Spdl.

6. Tap trepanned recess 1/2 x 12 — Vert. Spdl.

7. Drill 13/64 hole to half depth — Vert. Drill Spdl.

8. Hollow mill large O.D. and finish drill 13/64 hole (combn. tool) — Vert. Drill Spdl.

9. Ream .176 dia. hole 1-3/16 deep — Horiz. Drill Spdl. Remove chips from trepanned cavity — Vert. Drill Spdl.

10. Automatically unclamp (air cyl.).
11. Automatically Ejects.

PRODUCTION

Machine equipped with . . .

4 Horiz. Drill Spindles
5 Vertical Drill Spindles
1 Vertical Tap Spindle

One operator produces a completed part every 3 seconds — 20 pieces per minute — 200 operations per minute.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

480-48

Do you recognize these HOLTITE fastenings? Guess what industry uses each of them. Check yourself by the list below.

CONTINENTAL makes them all and thousands more

Of all the 400,000 varieties of fastenings that literally hold our industries together, Continental makes a large proportion marketed under the famous HOLTITE trade name. Most of them are standard — screws, nuts, and bolts for every use in every industry. Others like the well-known HOLTITE-Sems and HOLTITE-Phillips screws are patented specialties and the famous HOLTITE-Thredlock, Locktite and Tap screws were first designed and produced by HOLTITE. Sometimes a fastening engineered by HOLTITE for one industry finds an unexpected use in another. Often a HOLTITE-*Engineered* fastening will replace several parts that a manufacturer is using. Why not discuss your fastening requirements with a Continental Sales-Engineer. He will focus on your requirements all the broad industrial-fastening experience and ingenuity of Continental. Remember Continental is constantly improving HOLTITE products, lowering their cost and broadening service.

ENGINEERED FASTENINGS FOR PRODUCT ENGINEERS

A. HOLTITE-Phillips Type "H" Brass Tap (coarse thread—patented slotted point) Screw designed to eliminate taps and tapping operations in fastening polystyrene refrigerator assemblies.

B. Hex-head lag screw, a special development for fastening metal to wood in aircraft assemblies.

C. Special shaped screw to hold sections of home utensil in alignment by small lug at end of thread. Assures proper assembly of utensil after cleaning.

D. HOLTITE-Phillips Set Screw, used in assembling glass panel store fronts. Eliminates driver damage to costly polished panels. Screws made of Aluminum, Stainless Steel or Silicon Bronze to prevent staining.

This Trademark HOLTITE T. M. REG. U. S. PAT. OFF. *means made by —*

CONTINENTAL SCREW COMPANY

1904 NEW BEDFORD, MASS., U.S.A. 1949

your product. He will be less likely to pass him off as a constantly dissatisfied moron. And he may have a better idea of the problems facing your suppliers too.

He then, has become a carrier of idea germs, an ambassador of understanding among the plants he knows, whether he realizes the fact or not.

If this is true, then why can't we use this fact to our advantage? Why not initiate a sort of sabbatical leave to employees at all levels on a reciprocating basis with our associated customers and suppliers? For instance: a screw-machine setup man would benefit greatly from a year in a screw-machine builder's plant, and some similarly waged man in the builder's shop would go home after his leave with a better idea of the problems his machines face in the high-production shop.

Perhaps this is Utopianistic, but that Itching Baccilus has been making us scratch for a long time. Why not put it to work to our advantage for a change?

Donald E. Wood
Allegan, Mich.

•

I wonder if Al ever ran away from home when he was a kid? Or, when he started "dating" if he dropped the girl he married and dated some other girl a few times?

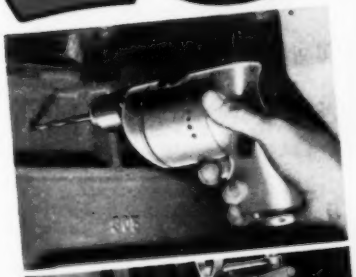
If a man leaves a place and then comes back that does not make him a rolling stone. He may have wanted to have a vacation in a change of shops and shop methods. Even if he did not feel that he was getting into a rut he had a vague sense that he needed a change.

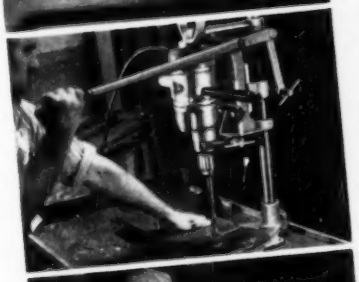
I have seen men fired because they were not up and on their toes or were lagging in production and then after a few months or a year have come back and made crackerjack men. They could not be classed as floaters.

I have seen and worked with men who were floaters—men who never worked in any shop more than a few months or a year at the most. A lot of them brought in a number of good ideas that they learned in other shops. They were just plain bums and never would amount to a darn.

A man that is raised in a shop and does not know how other shops are run has only one view of things and sometimes is a hundred years behind times. If he starts in one shop and quits to go to another shop or even two or three the very fact that he came back showed that he had a love for the old shop and would likely make a much better man than a man of the same experience who is

25 ways to CUT DRILLING COSTS!





Black & Decker Drills give you MORE WORK . . .

Per MAN Large or small, all B&D Drills are perfectly-balanced, weight-saving, designed for easier handling. They reduce operator fatigue. They help your men produce better, with the *right* Drill for *every* job—from a matchless choice of 25 different models!

Per HOUR Driven by famous B&D-built universal motors, Black & Decker Drills have full power and speed to drill more holes per hour. Their non-stalling, non-stop, accurate performance avoids delays, keeps your work rolling!

Per TOOL B&D Drills give you more work for your money because they're built for *extra* years of unfailing service. Extra-tough gears, shaft and chuck spindle, powerful motors and husky housings are all *built to last!*

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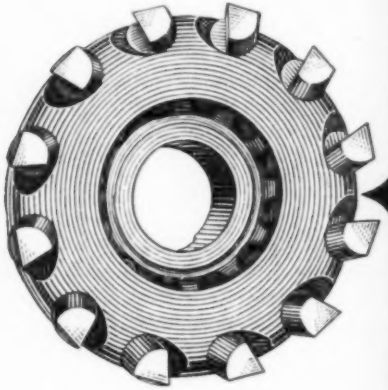
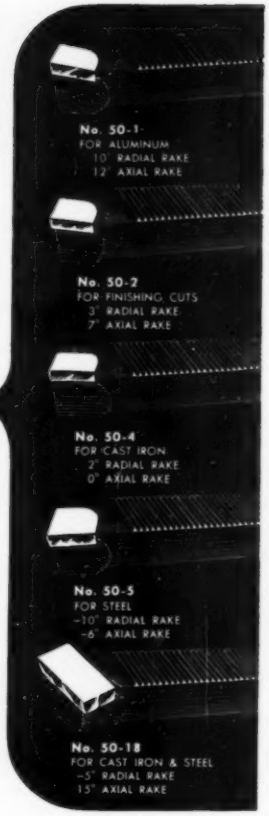
MODERNIZE WITH CARBIDE





ANY OF THESE BLADES* WILL FIT ANY LOVEJOY STANDARD 4½"-24" DIA. TYPE "A" CUTTER EVER BUILT!

More proof of Lovejoy Milling Cutter economy. Even if you have Type "A" mills that are 30 years old, you can utilize them to full advantage with carbide tipped blades with either positive or negative rake. The housings, whether 4½" to 24" in diameter, all take the same blade size. Their rigid construction permits the use of only ½ the regular number of blades, increasing chip load with low H.P. Thus you need no large blade inventory, but can rely on Lovejcy's large stock and prompt delivery with tips of any standard grade. You can, of course, use these same housings for standard H.S.S. or cast alloy blades —here too a single blade size will fit the complete range.

*A single size of H.S.S. and cast alloy blades will also fit every housing size.

"TOOL BITS"

Modern shop technique often calls for milling cutters with negative rake blades. Although certain phases of this technique are standardized, new discoveries on speeds, feeds, rake angles, etc. are being discovered regularly. Lovejoy is in constant touch with these new developments, both through their own experiments and through reports from production plants in all parts of the country. Lovejoy will be pleased to supply any information in its files and all newly acquired data. When inquiring, please give details on machine, material to be cut, etc.

Lovejoy
TOOL COMPANY, INC.
SPRINGFIELD, VERMONT

a stranger to the shop. He will probably be more loyal. The man who has a long time of shops behind him is the one that is liable to quit and drift on in an emergency. The man who has gone out into the world and comes back is much surer to stay.

If Al ever ran away when he was a kid he probably remembers how wonderful his mother's cooking tasted when he got home—even if she did spank him for running away. Also maybe he does not want to remember that time he ran out on Sadie, the girl he did marry, and took that cute little blond to the Fourth of July picnic. She was cute and he was the envy of all the boys that day but she sure spoiled his fun. If he suggested that they do something it was childish. And what she wanted to do certainly put a crimp in his bankroll. Sadie certainly looked sweet when he did see her again and you can bet your bottom dollar that he never ran out on her again.

Hire back the boys who have taken a vacation. They will make better men. Or even "farm out" a good man in another shop and let him get some good ideas. (This has been done and is quite common in baseball.) The shop will be all the better for the experience the boys get.

Of course it can be overdone. If a man shows an inclination to work a year or so and then go to another shop for a few months and then expect to be taken back it might get to be a habit and in that case it would be better to tell him to keep on drifting.

Chas. O. Rankin
Ontario, Calif.

•

The question of the rolling stone is rearing its ugly head again. This problem, one that is hashed and rehashed in almost every type of concern, is one that I believe has its best advantages in the rehiring of the employee. That is, if the man left his job because he felt that he was growing stale and needed a change, forced to move because of health conditions of his family, or released because of lack of work.

There are many of us, who, after a time, feel the urge to pick up more information in our line of work. There is only a certain amount of skill that can be learned in any one shop, and in order to become a jack-of-all-trades as we so often term our leading mechanics, the learner must travel afield to see how the rest of the world progresses.

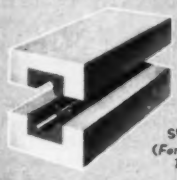
No, I am not in favor of the man who cannot hold a job because of

"50 Times Better"

Talide
(TUNGSTEN CARBIDE)
Drawing Dies

TALIDE METAL MEETS EVERY REQUIREMENT

PIERCING AND LAMINATION DIES



SWAGING DIES
(For Forming Solid and Tubular Shapes)

POWDER METALLURGY DIES *(For Compacting Powdered Metals and Materials)*

Talide Dies outwear steel dies 50 to 1. Production runs of over 1,000,000 pieces are commonly obtained. Long life of super-hard Talide Dies reduces down time, increases output, lowers unit cost and makes a better product.

Tungsten Carbide Dies take and hold a brilliant polish, thereby imparting a better finish to your product.

Talide Metal Dies range in size from pin point to 24" I. D., and in many complex shapes . . . used for blanking, drawing, swaging, extruding, spinning or curling.

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BLANKING AND FORMING DIES
(For Stamping Lamination Discs, Metals, Plastics, Paper)

TUBE MANDRELS

HEADING AND EXTRUSION DIES
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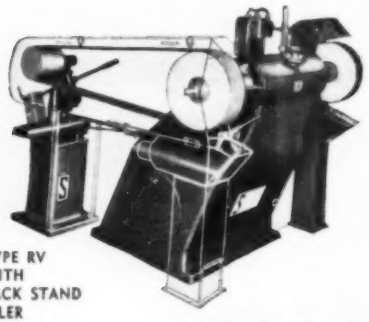

TYPE RV WITH BACK STAND IDLER

PEAK EFFICIENCY

IN YOUR LIGHT OR HEAVY DUTY

SNAGGING GRINDING and POLISHING OPERATIONS!

SAVE TIME ● SAVE MONEY . . .

The versatile STANDARD RV LATHE with BACK STAND IDLER provides substantial savings. The lathes are equipped with 4 heavy duty ball bearings run in oil, and a coincidental switch and brake. IDLER interchangeable for either right hand or left hand operation.

Buffing and polishing lathes available from 3 H.P. to 20 H.P. with speed ranges from 1500 to 3000 R.P.M. (other speed ranges available). Single and multiple speed machines available up to 60 H.P.

See this machine in operation at our Booth 1628 at the National Metal Exposition, Cleveland, O., Oct. 17-21.

This set-up belongs in your shop! Write today for catalog 44.

THE STANDARD ELECTRICAL TOOL CO.

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"What's so good about H-VW-M polishing wheels?"

JOHN D. KERSHAW
Field Representative
H-VW-M Grand Rapids Michigan Office

I like customers to ask frank questions. This fellow wanted facts, and no fooling. Of course, handling H-VW-M's line of electroplating and polishing equipment gives a guy plenty to talk about, so I got down to brass tacks.

"Show me any polishing job you have, and I'll show you an H-VW-M wheel that will do it better and save you money to boot," I offered.

"'Big talk,' you say? Well hold on a minute, we can back that up. H-VW-M has put a lot of years into testing and developing its line of polishing equipment, and 'by George' they know wheels inside out. They know whether cotton, canvas, leather or felt is best for the job; know how to cut, sew and glue the fabrics to withstand crushing and tearing strains incident to sharp, high-speed polishing; know how to provide sufficient flexibility, uniform density and proper balance so essential to maximum efficiency and long wear.

"But," I went on, "the important thing is that H-VW-M applies this knowledge to each wheel it turns out. That means when you specify H-VW-M polishing wheels, you're sure of getting the right wheel for your job every time.

"Tell you what," I concluded, "let's take a look at some of your polishing problems right now. We find that first hand analysis usually pays off in big savings to customers —and that's a service that is available to you anytime."

Ask your H-VW-M representative to help you solve your polishing problems, or write to "Headquarters"* for a copy of Bulletin W-102. It describes our complete line of polishing wheels and accessory products.

Hanson-Van Winkle-Munning has supplied the plating industry for over 70 years. Our sales-engineers are thoroughly familiar with every step in the process of electroplating and polishing. It is this overall knowledge that has made H-VW-M "Headquarters" for electroplating and polishing equipment, supplies and technical assistance.

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MATAWAN, NEW JERSEY
Manufacturers of
a complete line of electroplating and polishing equipment and supplies
Plants: Matawan, New Jersey • Anderson, Indiana
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3860

lack of interest or his own personal faults, but I am in favor of the man with the forethought to look ahead. With a purpose in mind, this fellow that learns as he goes will someday become some company's most valuable and respected man. There are few men heading our great industries who have not knocked around in their time. How else would they be able to catalog the reams of valuable information that enables them to stay in the field of competition?

This fellow, after a time of looking here and there, if he returns to his old position, is usually much the wiser in trade manners and capable of tasks that were foreign to him before his journey.

We should not punish the man with ambition. This will, in time, kill the spirit of individualistic talent and I need not tell of the result of such a consequence. If after looking around and perhaps holding down one or two other jobs during the period of absence, our man returns, I would greet him favorably and through a period of chatter, evaluate the returns of the knowledge gained. Usually, it only takes a few weeks to see through a man's working habits and if Jones or whatever his name may be, is just looking for a soft berth, time will soon tell. But by the same token, the step may be in the right direction and the shop will be that much to the good. Here is a man who has received his education at someone else's expense and now you have the chance to share in the harvest. I sincerely believe it is worth a couple of pay checks to learn if this seeker of higher aims has found some of the answers he set out for. There are too many shops with new machinery and stale hands at the controls. With our ever increasing search for better tools, why limit the field to machinery? The man running the job must be up to date to function with the highest degree of efficiency.

Jack Bell
Bakersfield, Calif.

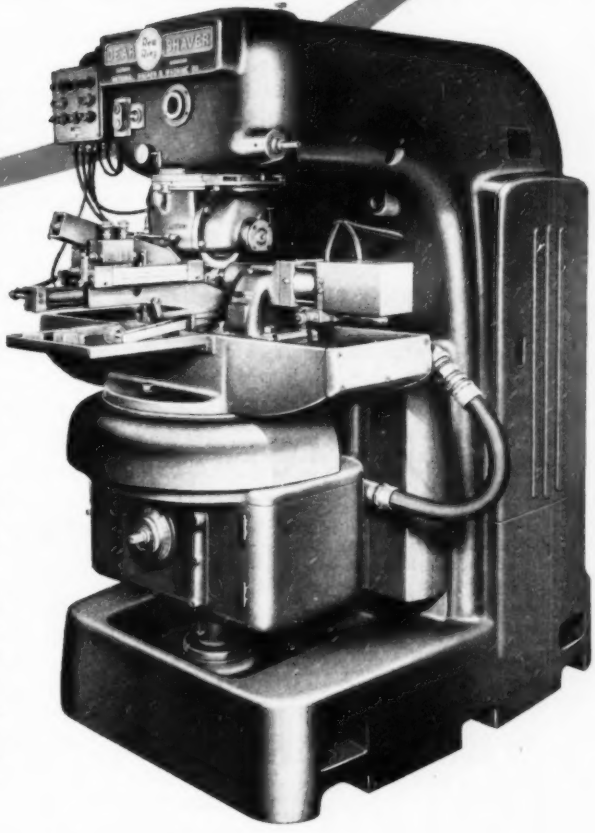
•

Al is certainly off his trolley to think that it is a mistake for a man to travel or to hire him back after he once leaves your particular shop. As Ed says, he is almost sure to come back a better man because of the different experiences he has had while in other shops. Some concerns have made the foolish ruling never to rehire a man who has left them, just as though he deserted the old shop and was a sort of pariah. Other concerns apply this only to executives, which is just as bad. This was said to be the policy of the old

AUTOMATIC LOADING permits you to turn out

Precision Gears with unskilled operators

at MAXIMUM PRODUCTION RATES



You as a gear manufacturer under present industrial and market conditions can correctly evaluate production equipment that:

❶ Assures extremely close gear tolerances consistently.

❷ Does not require any mechanical skill to operate.

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❹ Operates continuously at mass production speed.

That is precisely what you can have with Red Ring Automatic Loading in connection with Gear Shaving Machines GCU or GCV.

Either of these machines so equipped can be run continuously merely by keeping a supply of work gears in the magazine and removing the finished gears. One operator easily serves a battery of machines, for the entire machining operation is entirely automatic.

Production rates are phenomenal. Write for descriptive literature.

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real toughness
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free cutting

. . . an exceptionally adaptable alloy steel

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WL *steels are metallurgically constant. This guarantees uniformity of chemistry, grain size, hardenability—thus eliminating costly changes in heat treating specifications.*

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HY-TEN and AISI

Ford Company while Henry Sr. was in charge. This was presumably the reason that Harold Wills never went back after his experience in building the Wills-St. Clair car. There are excellent reasons for believing that he would have been more valuable than before. Instead his added experience went to Chrysler.

It used to be common practice for a shop to turn an apprentice loose as soon as he became a journeyman, with the idea of having him get more and wider experience in other shops. This was a very sensible practice as he was sure to learn a lot by working in other shops. He was free to come back when he wanted to if there was an opening for him. The old shop usually benefited by his experience in other shops. When the apprentice went from a shop building machine tools he was pretty sure to brag a bit about the machines he had worked on, which probably helped to sell some of them around the country.

From a somewhat different angle, one well-known builder of machine tools gladly sent one of his good foremen or mechanics to work in new shops if they asked for good men. They knew it was good business and helped to sell their machines.

When it comes to executives being rehired, it is frequently the best sort of policy. One of my good friends was superintendent of a well-known automobile plant at three different times, always coming back at a higher salary than before. He was a shining example of "the rolling stone gathering the shekels" instead of the moss that he was supposed to miss if he wandered from the old fireside.

Fred H. Colvin
Pt. Pleasant, N. J.

"Have you ever seen a hammer with so much drop?"

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MECHANICAL "HANDS"
Here's how to
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ASSEMBLY OF WOOD PARTS, DOORS TABLES, CHAIRS, ETC.
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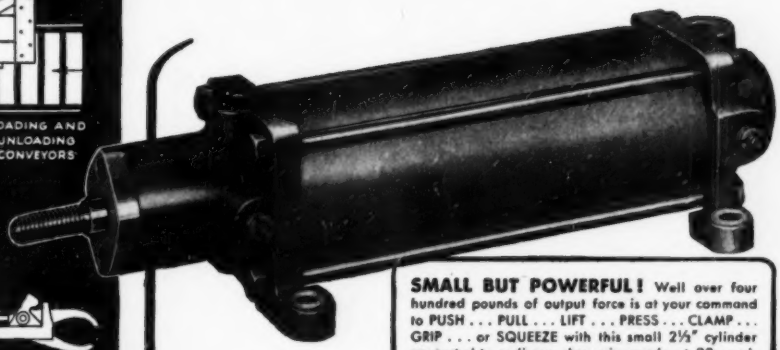

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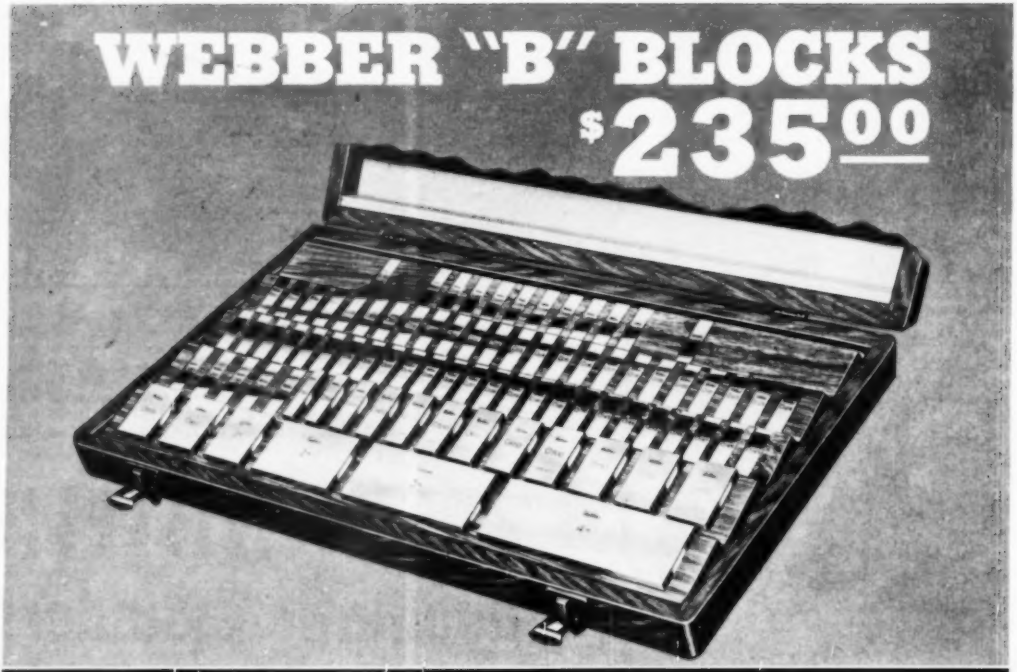

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Here is more precision per dollar than you can find in any other block! Other prices have sky-rocketed in the past 10 years. But you still can buy an 84-block set of Webber Gages today at the 1939 price with the same inherent qualities, careful inspection and long wear that have made Webber the nation's largest exclusive manufacturer of precision gage blocks.

Carblox Wear Gages add the wearing qualities of carbide to any standard steel gage block set. Set of 2 with case. Two Sizes.

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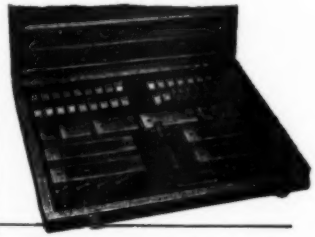

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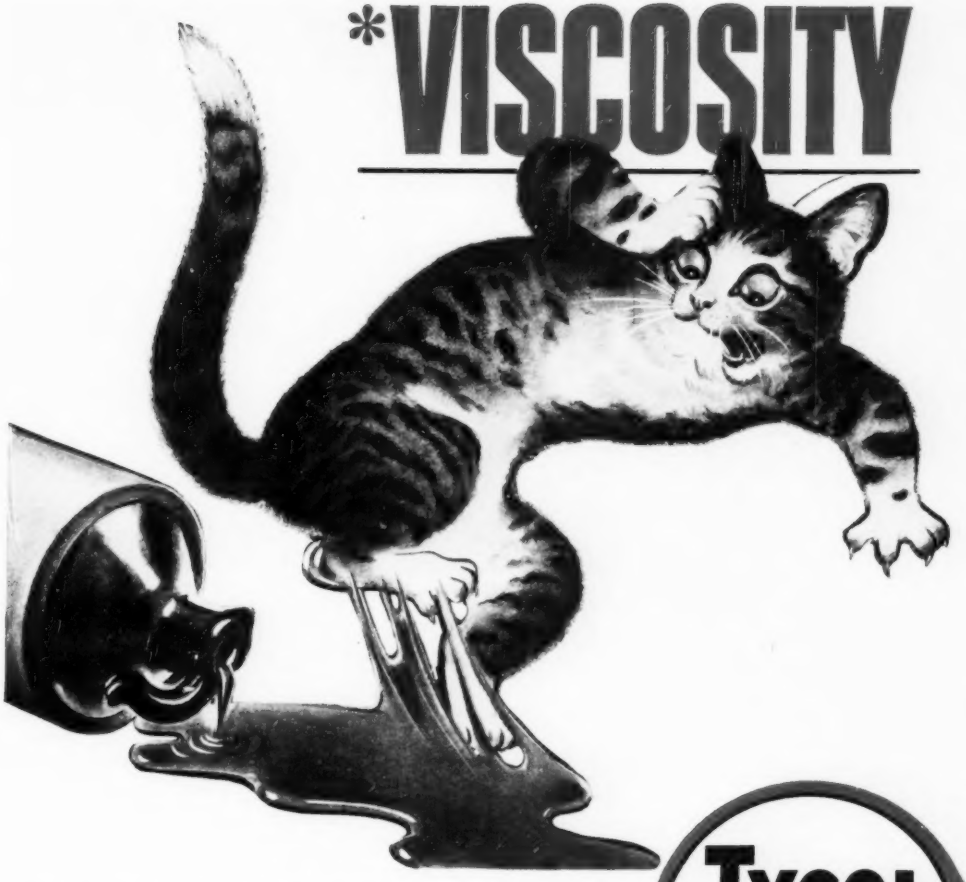

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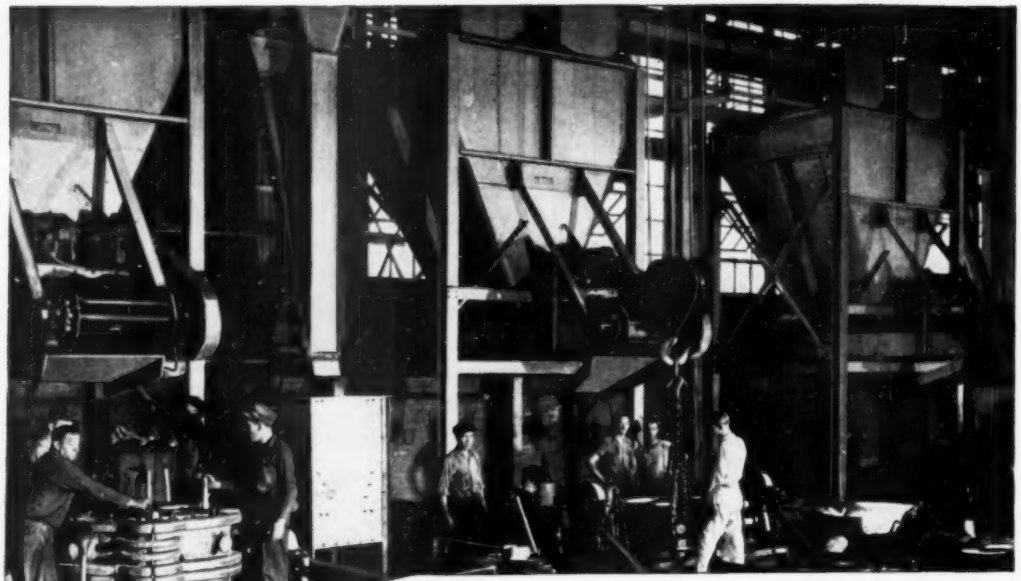

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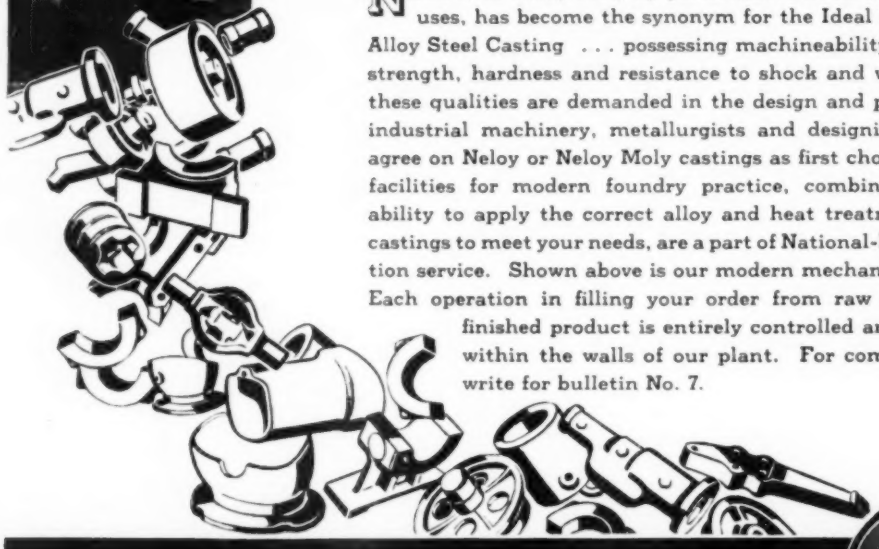

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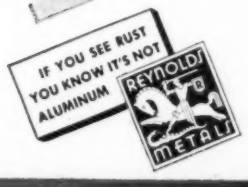

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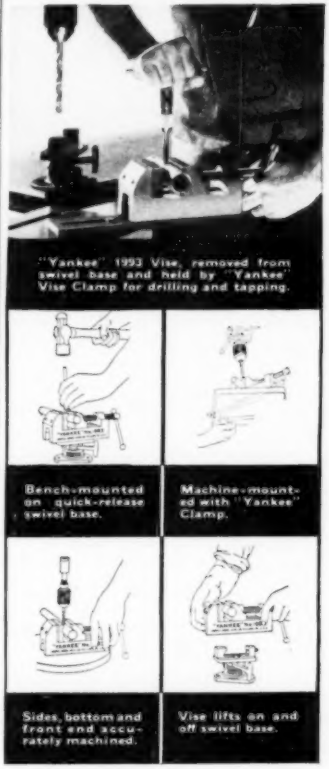
"Yankee" 1993 Vise, removed from swivel base and held by "Yankee" Vise Clamp for drilling and tapping.
Bench-mounted on quick-release swivel base.
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Sides, bottom and front end accurately machined.
Vise lifts on and off swivel base.

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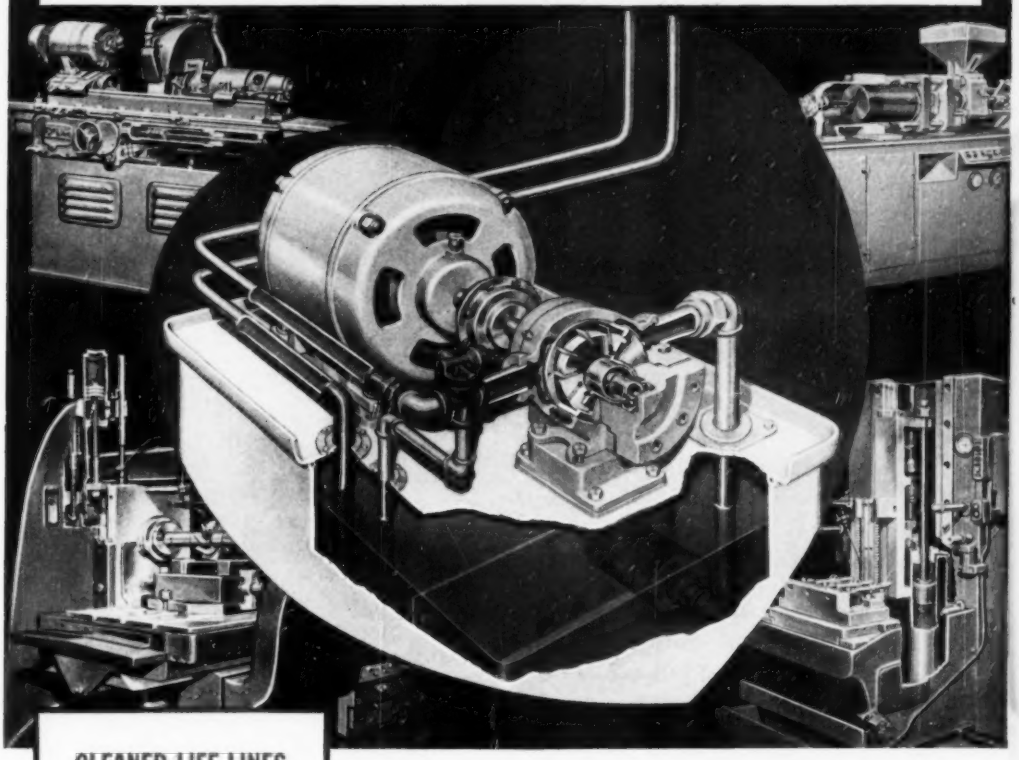

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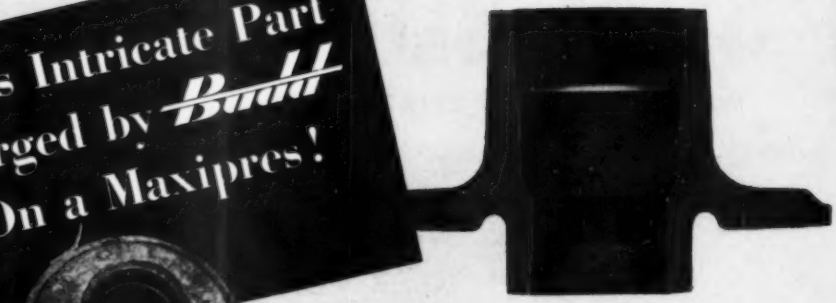
This Intricate Part Forged by Budd On a Maxipres!



CUT-AWAY VIEW OF FORGING

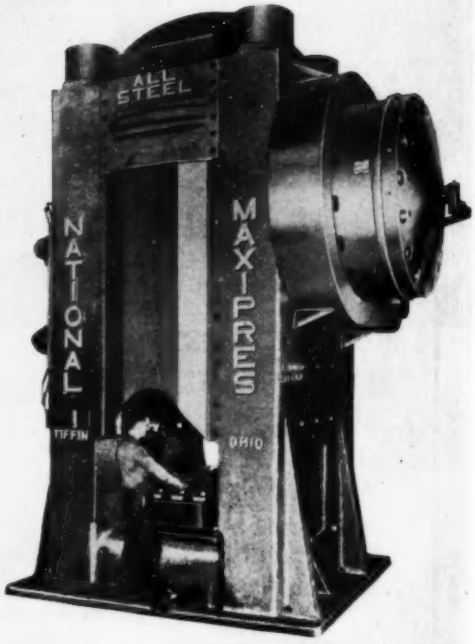
TRIMMED FORGING

SLUG FLASH

The automobile wheel hub illustrated above is forged by The Budd Company, Wheel Division, Detroit, Michigan, on a National No. 6-A MAXIPRES.

The blank for this intricate forging weighs six pounds, four ounces; with only four ounces of stock lost in the form of the flash ring and center slug.

Here is another example of how MAXIPRESSES are used to produce superior forgings at lower cost.



75th Anniversary 1874-1949

NATIONAL
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TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET, AND WIRE NAIL MACHINERY

New York Detroit Chicago

LEAD-SCREW FEED FOR *Better* PRECISION THREADING....

- Wide open tooling area.
- Quick main tool-slide stroke settings on graduated worm wheel.
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- Standard interchangeable cross-slide cams.
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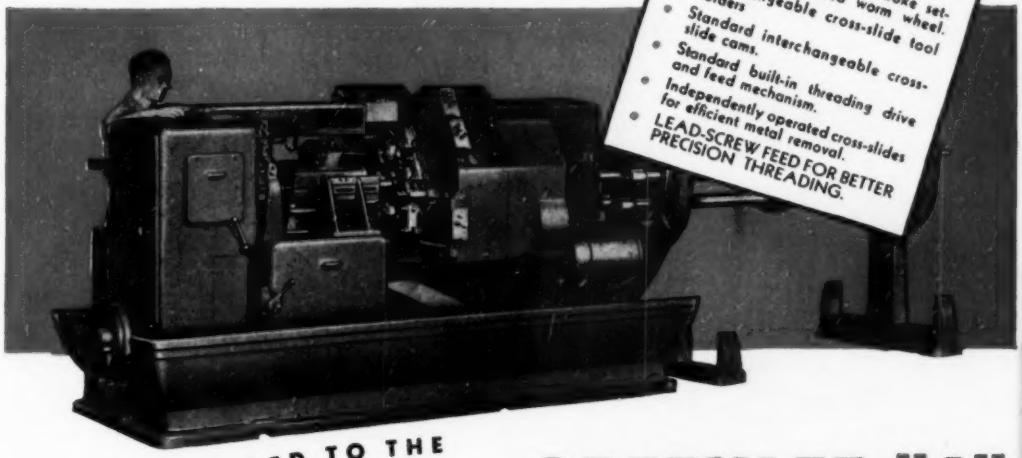
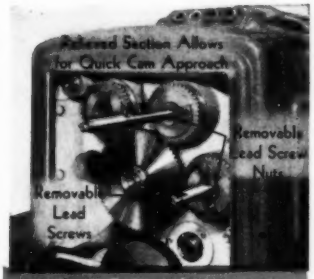
- Independently operated cross-slides for efficient metal removal.
- LEAD-SCREW FEED FOR BETTER PRECISION THREADING.



HAS BEEN ADDED TO THE OUTSTANDING FEATURES OF **GREENLEE "6"**

AUTOMATIC SCREW MACHINES



(Above) End gear box cover removed, showing lead screw threading spindle drive shafts in 4th and 5th positions. (Below) These Greenlees produce industrial hose couplings and fittings at Anchor Coupling Co., Libertyville, Ill. Front machine has lead screw feed.

Operators on Greenlees have plenty of elbow room to work in the tooling area, for changing tools, making adjustments, checking work during set-up, etc.

Change-overs are speeded by a quick and easy adjustment for the main tool-slide stroke. No cams to struggle with—just a simple setting to make on a graduated worm wheel.

Tool-holders for the cross-slides are interchangeable so any tool fits all cavities.

Feed-setting on cross slides is fast and simple, using standardized and interchangeable cams — any of which will fit any slide.

Cam-controlled threading feed is a *standard built-in feature* on Greenlees, including built-in drive sleeves in four positions.

Cross-slides are independently operated — permitting the set-up man to select from a wide variety of tooling arrangements and make adjustments as necessary.

AND NOW an extra feature to meet modern production demands — LEAD SCREW FEED for extra power and precision on threading operations. The mechanism can be added to most existing Greenlees at low cost.

FREE LITERATURE

Learn more about these and many other valuable Greenlee features that make this machine "The Operator's Favorite". Write today for bulletins — ask for Screw Machine Literature.

PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO., 1730 MASON AVE., ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

WITH DICKERMAN DIE FEEDS . . .

WE'VE DONE THE JOB IN ONLY 1/10th THE TIME

You Can Reduce Operator Time by **90%**

DICKERMAN AUTOMATIC DIE FEEDS INSTALLED

Add to this production phenomena, the FACT that the cost of DICKERMAN DIE FEEDS is so LOW they PAY FOR THEMSELVES the first month of operation.

PRODUCTION INCREASES up to 300%

Completely automatic and exceptionally accurate, these improved Feeds will handle Brass, Steel, Copper, Paper, etc., from any position on the press and REDUCE OPERATOR'S TIME BY 90%.

Ruggedly constructed DICKERMAN DIE FEEDS are made in many styles and sizes, can be easily installed on ANY punch press.

Also Manufacturers of HITCH FEEDS
ROL-DIE-FEEDS and AUTOMATIC STOCK REELS

WRITE FOR DETAILED INFORMATION

H. E. DICKERMAN MANUFACTURING CO.
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FRONT LEVER BENCH PUNCH

Capacity 7/16" hole through ¼" steel or equal.

•

Hand Operated Weight 70 lbs.
Immediate Shipment

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Punches and dies in a large range of round, square, flat, and oval sizes are carried in our New York stock.

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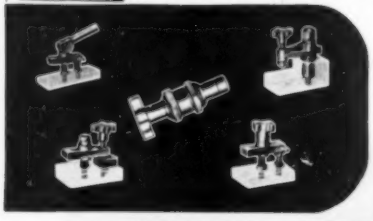
Send for circulars illustrating and describing our line.

T. H. LEWTHWAITE MACHINE CO., INC.
313 East 47th St., New York 17, N. Y.

M-T FIXTURE CLAMPS AND COMPONENTS



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FIXTURE CLAMPS—wide range of sizes and types to fit every requirement. JACK LOCKS . . . Cam Locks . . . Hand Knobs . . . Hand Wheels . . . Steel Ball Handles . . . Soft Chuck Jaw Blanks . . . Fixture Cams . . . Alloy Set-up Studs . . . Rest Buttons and Rest Pads . . . Spherical and Plain Collar Nuts . . . Quarter Turn Screws . . . Fixture Keys . . . Spherical and Flat Washers . . . Shoulder Screws and many other items from stock.

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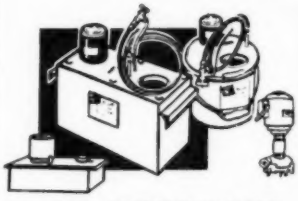
NEW PUMP and COOLANT SYSTEMS



SAVE ON PRODUCTION COSTS

Tools last longer, cut better when GRAYMILLS COOLANT SYSTEMS are used. Save on tool replacements and time-per-job. Units available for grinders, drill presses, etc.

New Centrifugal Models unaffected by abrasives. Capacities 1 to 70 g.p.m. Up to 80 psi. Tanks 1 to 38 gallons.

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COMPLETE COOLANT SYSTEMS FOR AS LOW AS **$41.50**

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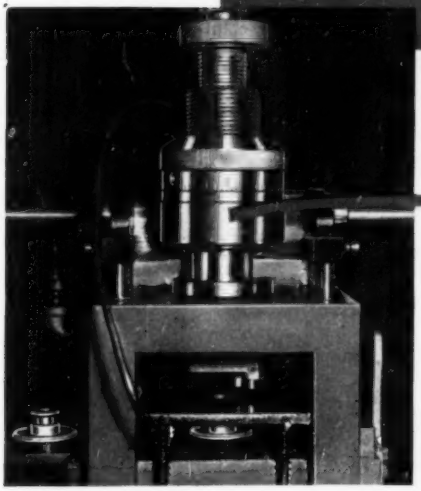

Scully-Jones Standard Type "J" Automatic Recessing Tool with special circular form cutter; being used at Grigsby-Allison Co., Inc., Arlington Heights, Ill. on a small Delta Drill press, to cut external groove on a zinc die cast clutch gear, at a rate of 300 per hour.

Scully-Jones Standard Type "J" Automatic Recessing Tool. Types "J" and "C" are designed to pilot in a fixture bushing and are used in drill presses and turning machinery.

Scully-Jones Standard Type "R" — size 2R Automatic Recessing Tool. Sizes 2R, 4R and 5R pilot in the hole or stop on the face of the work and are used in drill press, automatic screw machine or turret lathe operation, or in setups where it is impractical to mount a pilot bushing.

Do Them Easily with SCULLY-JONES standard AUTOMATIC RECESSING TOOLS

(Three Types—Five Sizes)

You can do any of these with Scully-Jones Standard Automatic Recessing Tools: retainer ring grooves; reliefs for tapping, threading, grinding, honing; chamfers; second operations on cast or molded parts, or a combination of these operations.

DOWN go recessing costs —UP goes production

RESULTS THAT PAY

You get these results with Scully-Jones Recessing Tools:

1 Make many recesses with a single Recessing Tool, by merely changing tool bit holder or circular form cutter.

2 Operate on standard production machines—no costly special machines needed.

3 Maintain close tolerances—reduce rejects.

4 Get long life—low maintenance cost—as all parts are hardened and ground, and built to take severe punishment.

5 Speed up production—cuts costs, because tool operation is automatic.

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Write on your company letterhead for a free copy of our new 28-page Manual No. 17-2. It gives you a clear picture of the application, operation, construction and many advantages gained by using Scully-Jones Automatic Recessing Tools.

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YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

HERE'S A NEW WAY TO PRODUCE ACCURATE HOLES

Universal joint eliminates need for alignment between power unit and hole.

Honing pressure adjustment regulates stone cutting pressure for different metals, ceramics, glass, etc.

Feed-up control expands honing stone.

THE NEW SUNNEN PORTABLE HONING HEAD
Fills needs in every shop!

- *Production*
- *Tool and Die*
- *Machine Shops*
- *Maintenance*
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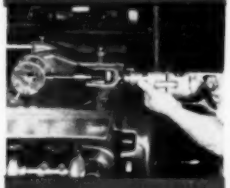
Here's a new tool that will prove to be one of the best time and money savers you ever used! Take it right to the job — use with electric or air drill, lathe or drill press — hone straight, round holes with guaranteed accuracy of one ten-thousandth and surface finish as fine as 2 micro-inches R.M.S.

With Sunnen self-centering honing heads you can remove large amounts of stock — or only that "last ten-thousandth," with assurance of perfect fits every time. You'll find them just right for honing dowel pin, leader pin and ejector pin holes... extrusion dies, guide pin and drill jig bushings... for sizing and finishing during machinery assembly... for production, salvage, maintenance and repair work.

Seven heads accommodate standard Sunnen honing mandrels covering a diameter range of .120" to 1". Each complete honing head costs only $19.80 — *often pays for itself on the first job!* Let us show you the many different jobs these cost-cutting tools are handling for others. The coupon will bring you full details.



Ideal for machine maintenance. Here the operator is re-sizing holes in a screw machine turret.

Removing distortion from valve housing of hydraulic speed control. Sunnen Honing is 10 times faster than former method (lapping).

Honing bushings after assembly in housing of large hydraulic pipe threading machine. Removes distortion for a perfect free running fit. Honing tool is also ideal for salvaging large castings with defective holes.

In the tool room, portable honing heads produce extremely accurate holes with long-life finish, in record time.

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STREET.....

CITY.....ZONE.....STATE.....

SUNNEN HONING
"Low-cost production of precision holes"

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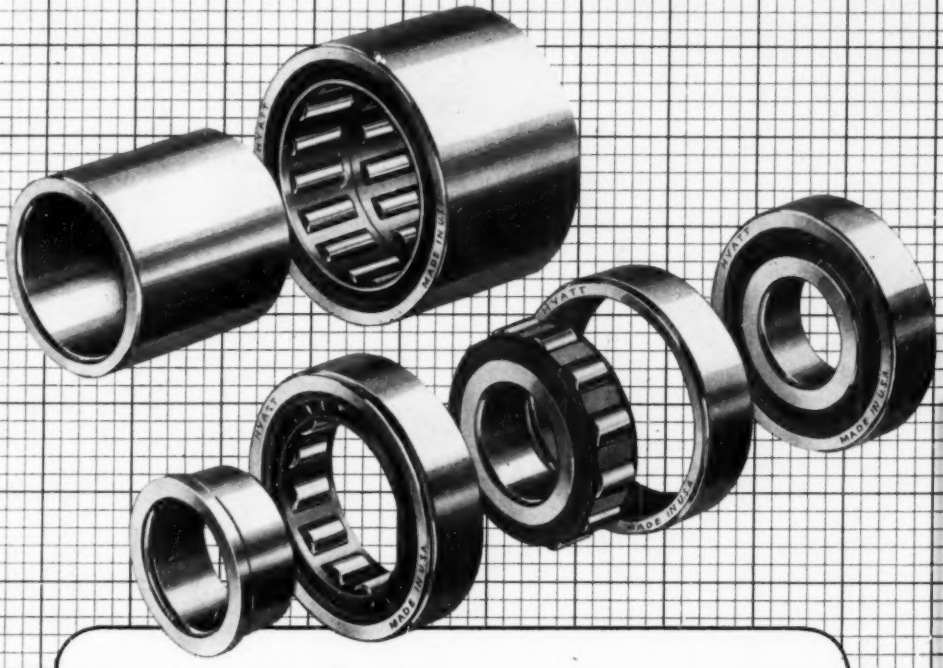

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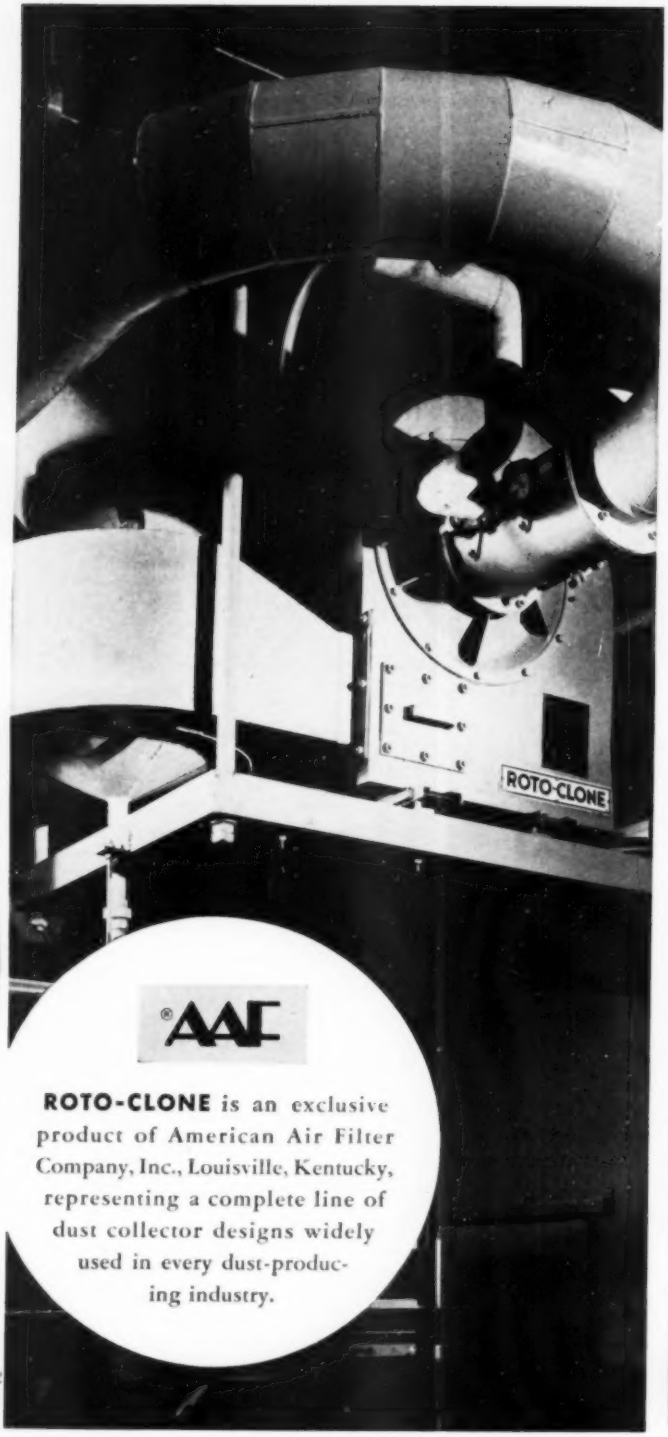
High carrying capacity is just one of the many advantages of Hyatt Hy-Load Roller Bearings. Others include: complete interchangeability of separable parts, option of omitted race operation, adherence to standard AFBMA dimensions, more than 500 sizes—in two diameter series, wide and narrow widths.

Where loads are tough and service is rough, Hy-Loads deliver the smooth, sweet, trouble-free performance that means years and years of satisfaction in machinery and equipment of all types.

In mills and factories . . . on farms . . . oil fields . . . railroads . . . highways and skyways Hy-Loads are daily proving that better bearing design means better machine design and performance. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS



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ROTO-CLONE is an exclusive product of American Air Filter Company, Inc., Louisville, Kentucky, representing a complete line of dust collector designs widely used in every dust-producing industry.

WISE ECONOMY • WISE SELECTION of CUTTING FLUIDS • WISE ECONOMY

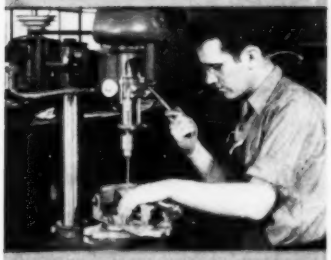
Learn about the WISE ECONOMY PLAN. Visit the D. A. Stuart booth No. 426 at the National Metal Congress & Exposition or write, wire or phone D. A. Stuart Oil Co., Ltd. for further information. (Telephone BIshop 7-7100.)

D. A. Stuart Oil Co.

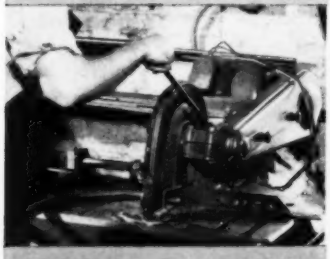
2729 S. Troy St., Chicago 23, Illinois

Delta's line of band saws includes Delta 14" Metal-Cutting Band Saw, shown in use here, and the new Delta 20" Band Saw for cutting wood, plastics, and soft metals such as brass, copper, and aluminum.

Delta's line of abrasive finishing machines includes the Delta Abrasive Belt Finishing Machine used above, the Delta Abrasive Disk Finishing Machine, and the new Delta Belt Grinding, Polishing, and Deburring Machine.



Delta's line of drill presses include 14" and 17" single- and multiple-spindle, bench and floor models, with manual or power feed. Also included are Delta Super-Mite Drill Presses, for small-hole work from .025" to ¼" diam.



Delta Cut-Off Machines are available in a non-ferrous model and an abrasive model that is also adaptable for cutting wood.

Delta's line of grinders includes this Delta Toolmaker* Surface Grinder, as well as the Delta Toolmaker Chip-Breaker Grinder, Delta Toolmaker Tool and Cutter Grinder, Delta Carbide Tool Grinder, and Delta Grinder with Twin-Lite* Safety Shields.

Here's how DELTA-MILWAUKEE® Machine Tools help you *maintain volume and quality — with big savings*

There are many ways you can use low-cost Delta-Milwaukee Machine Tools to cut your operating costs, without penalizing output and quality: Here are three . . .

1. You can build high-production, special-purpose machines using standard Delta components—without the delay and heavy capital outlay ordinarily involved in buying inflexible special machines of limited usefulness. Machines using Delta components are readily convertible when change overs are required.
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DELTA MILWAUKEE®

Delta's savings in cost — and in weight and space — are not obtained at the expense of quality. They result from advanced design and from quantity production of standard models.

Take advantage of the many uses of Delta-Milwaukee machines, to cut your investment risk in tools and retain more liquid working capital. Inspect them at your nearby Delta distributor. Ask him about buying on easy time payments.

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Look for the name of your Delta Distributor under "Tools" in the classified section of your telephone directory.

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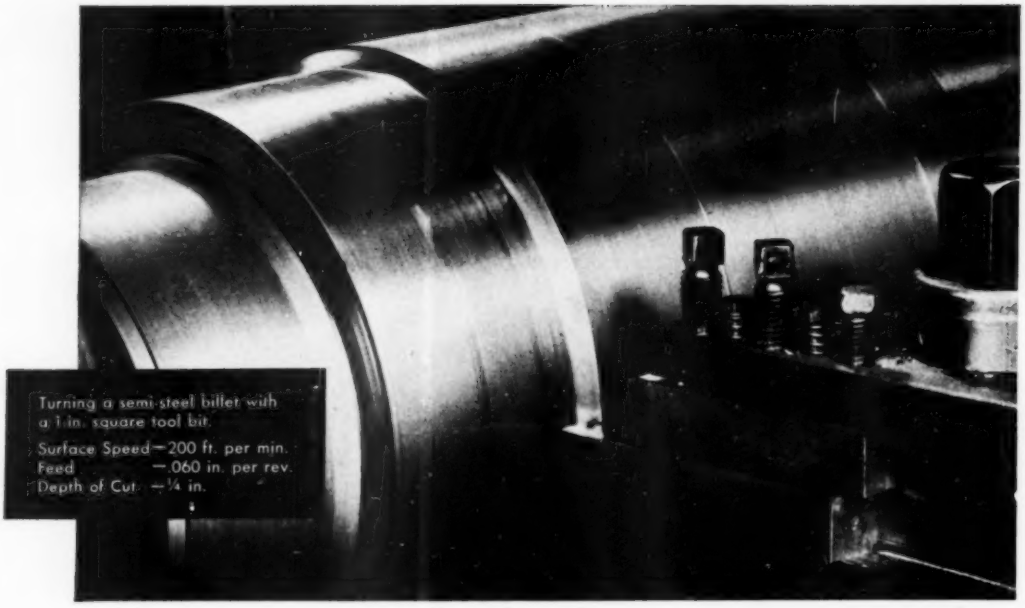

Faster METAL REMOVAL

with HAYNES STELLITE *metal-cutting tools*

HAYNES STELLITE metal-cutting tools remove metal faster by making heavier roughing cuts with heavy feeds. Long tool life between grinds is assured because HAYNES STELLITE tools are balanced in red-hardness, edge-strength, toughness, and abrasion resistance. The result is greater production at lower cost per piece machined.

HAYNES STELLITE cutting tools are especially suitable for turning, facing, boring, grooving, forming, and milling most types of steel and cast iron. These tools are also widely used for machining practically all types of non-ferrous metals and non-metallic materials.

You can order HAYNES STELLITE standard tools, or special tools made to your specifications, through any Haynes Stellite Company office. For more descriptive information, write for the new revised edition of "HAYNES STELLITE Metal-Cutting Tools," Form 5401.

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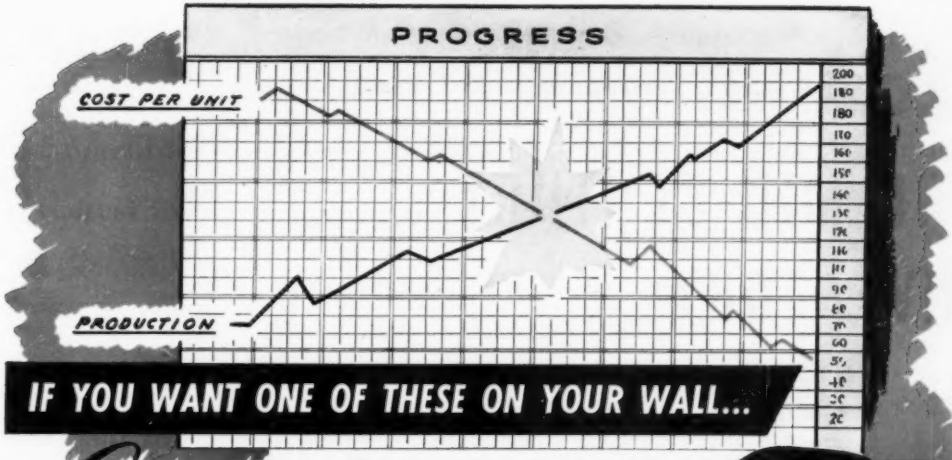

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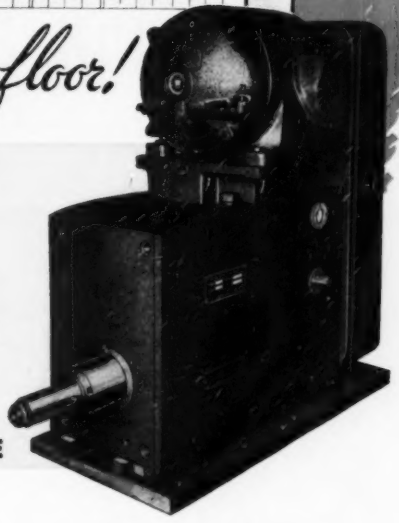
Get one of these on your floor!



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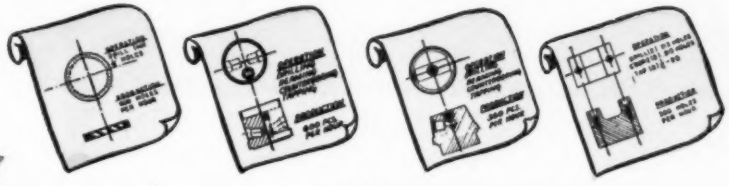

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1 The number and age of the machines and other equipment now operating in Metalworking production shops.

2 How the metalworking plants in their geographical areas compare, in relative obsolescence, with those in all other major areas of the United States.

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1 The general condition of Metalworking's production shop.

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4 Those manufacturing divisions of Metalworking which are, or are not, doing an outstanding job of applying those advertisers' equipment to modern production problems.

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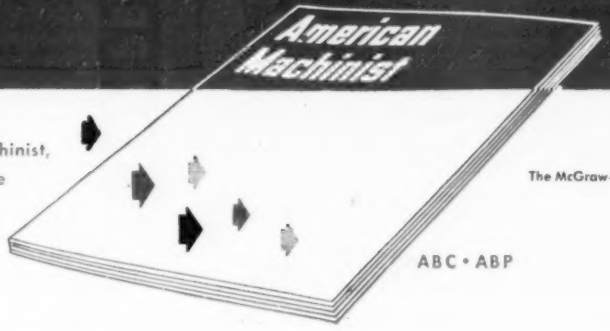

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The McGraw-Hill Magazine of Metalworking Production

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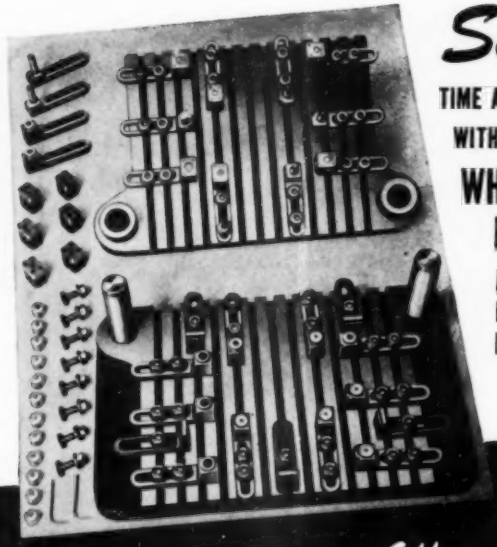

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Adjustable Perforating Die Set

Special Introductory Offer

To prove the advantages of Whistler Adjustable Dies under your production conditions, we are offering these U-375 units at a special low price.

1 DS-1012-1 (10" x 12") T Slotted Die Set
12 DR-375 Die Retainers
12 PR-375 Punch Retainers
12 PU-375 Round Punches
12 DBU-375 Die Bushings
12 S-375 Strippers
12 LLP-375 Locating Pilots
4 GA-375 Standard Gauges
1 SUP-375 Set-Up Plug

Punches and dies are your own selection of sizes from 1/32" up to 3/8" diameters. Everything needed to start production is included.

Shipped complete upon receipt of your order for only . . . . . **$280** Net F.O.B. Buffalo, N.Y.

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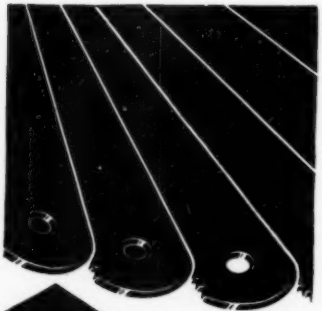

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That's because they are made from the finest steel, scientifically manufactured and properly heat treated. Results, a faster clean cutting long life hack saw blade insuring maximum performance at minimum cost.

Your local distributor will help you choose the proper STAR blade for your job and will supply you with a free STAR Metal Cutting Booklet or Wall Chart for your shop. Both packed full of useful information.

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Makers of Hand and Power Hack Saw Blades, Frames, Metal Cutting Band Saw Blades and the Clemson Lawn Mach.

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A GREAT NEW BLADE...
with GREAT NEW FEATURES...
for GREAT NEW ECONOMY...

For Cutting Every Kind of Lower Alloy Steel

ATKINS *Silver-Flash* BLADES

for Every Hack Saw Frame

Worthy companion in its own field to Atkins famous "Silver Steel" Blades, the all-new ATKINS SILVER FLASH Hand Hack Saw Blade is an outstanding improvement for the cutting of all kinds of lower alloy steels.

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ATKINS SILVER FLASH produces exceptionally smooth cuts to close tolerances, with a speed and ease far in excess of ordinary hack saw blades. Add longer blade life and you see why ATKINS SILVER FLASH Blades result in substantially lower metal cutting costs.

There's an ATKINS Blade for Every Hack Saw Job

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The most honored name in hack saw blades for more than 25 years. For cutting tough, high carbon steel or any other metal that can be cut with a hack saw. Both hand and power blades.

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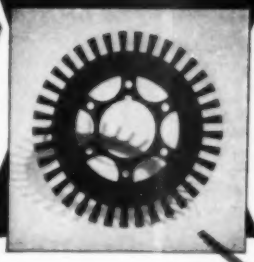
MAKERS OF BETTER SAWS FOR EVERY CUTTING JOB

DIE MAKER SAVED 40 HOURS on the die job for this part

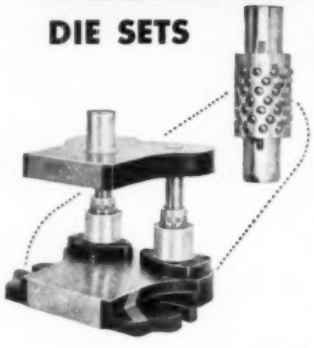


CUSTOMER GAINED 375,000 ADDITIONAL PIECES

Armature lamination of silicon steel was punched out in a single crack in a hand fed press. Lempco equipped dies yielded 375,000 extra pieces over conventional die sets.

Die maker also saved forty hours in die assembly and tryout over previous record, due wholly to precision of preloaded ball bearing bushing of Lempco Die Sets.

LEMPCO DIE SETS



SAVE TIME IN DIE ASSEMBLY

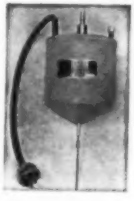
GET MORE PIECES PER GRIND

Dies open and close freely with perfect alignment that saves die wear, increases production per grind, cuts costly down time and yields pieces with cleaner cuts, minimum of burrs and rejects.

Write for catalog of
STANDARD and SPECIAL DIE SETS with preloaded bearings between leader pins and bushings.

LEMPCO PRODUCTS, INC.
5490 DUNHAM ROAD • BEDFORD, OHIO

LOW-PRICED



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***Only* $95**

It's sensational! — Every shop, every tool crib should have one. Removes broken tools and studs by electrical disintegration from a part being machined without damaging the part. Saves castings otherwise scrapped. Set it up on your drill press.

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METAL SPRAYING

- **What It Is**
- **What It Does**
- **How It Is Done**

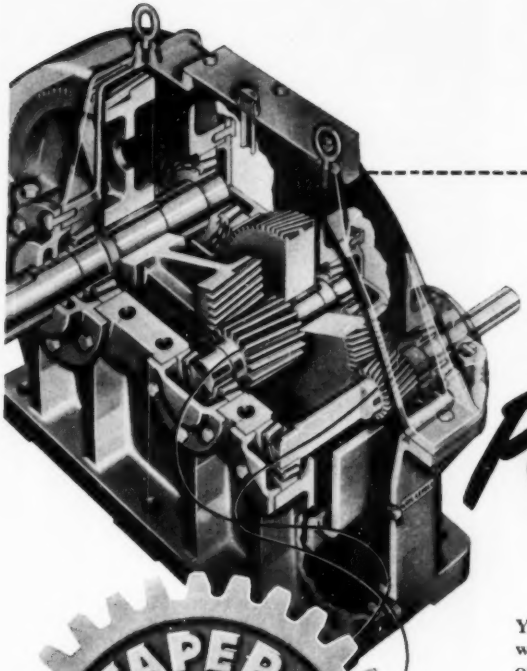
Reprints of this AMERICAN MACHINIST Special Report are now available. Twelve fact-filled pages point the way to economical production-line applications of the versatile metal-spraying process . . . offer you a fund of basic information on how the process can promote better, lower-cost production.

Copies of this helpful Special Report are available at 20 cents each, or 18 cents each in quantities of 100 or more. For a complete list of available reprints, write Reader Service Department.

American Machinist
McGRAW-HILL BUILDING
NEW YORK 18, N. Y.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Top Performance

for Slow-speed Drives

You get maximum performance from slow-speed drives when you use Westinghouse Speed Reducers. High operating efficiency and long service life are assured by important *plus* features inherent in Westinghouse design and construction. In addition, you are able to take advantage of Westinghouse undivided responsibility . . . a single source of responsibility for speed reducers, *and* motors, couplings and bedplates. Westinghouse extra values include:

- Taper-hardened BPT Gear Steel Gears, single-helical design . . . for maximum load-carrying capacity, quiet operation.
- Simple, positive lubrication—2-compartment oil reservoir.
- Rugged case of split construction, for easy accessibility.
- Tapered roller bearings—minimum friction loss.
- Nationwide service organization—competent help where and when you need it.

Call your nearby Westinghouse representative for further data, or write for Bulletin DB-3700-SR, Westinghouse Electric Corporation, Dept. 110, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-07283

TAPER-HARDENED

Taper-hardened Tooth Section

Case-hardened Tooth Section

Note how the exclusive Westinghouse "Taper-hardening" process gives BPT Gear Steel Gears high surface hardness . . . necessary for long wear . . . *PLUS* graduated hardness toward the root of the tooth . . . necessary for toughness.

Westinghouse

GEARED DRIVES

MEMBER OF AGMA

WESTINGHOUSE

HERE'S LONG-LIFE LOW-COST ACCURACY!

Ellstrom

CHROMIUM PLATED GAGE BLOCKS

Ever stop to measure true gage block value in terms of longer wearing millionths? Well, chances are if you do, you'll find you get a whole lot more for your money when you **specify "chromium"** . . . Ellstrom Chromium Plated Gage Blocks. Why? Because they give you *5 to 20 times longer wear* than ordinary blocks, yet they cost but very little more. They're rated "tops" in the industry, too, for all-around gage block quality. Made of finest materials. Produced under precisely controlled conditions. Finished to perfection with extra hard, longer wearing gaging surfaces. Unconditionally guaranteed to specified millionths to assure you of the absolute accuracy, uniformity, and durability you need. Yes, dollar-for-dollar, millionth-for-millionth, Ellstrom Chromium Plated Gage Blocks measure up to VALUE . . . the best investment you can make in long-life, low-cost accuracy.

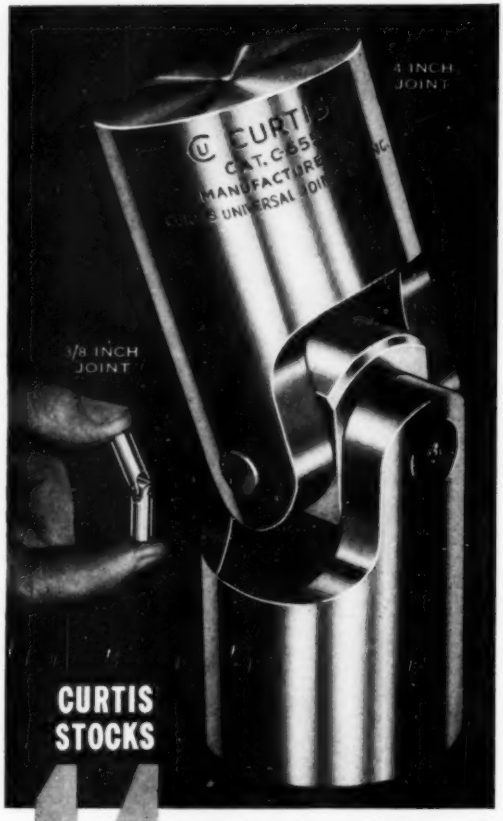
Get the New ELLSTROM Catalog of Standards!

Contains complete information and prices on standard Ellstrom Gage Block Sets . . . plus full details on Ellstrom's Inspection Service and Exchange Plan. Write for your copy today!

ELLSTROM . . . *measuring in millionths for 3 generations*

DEARBORN GAGE CO. 22033 Beech Street Dearborn, Michigan

Originators of Chromium Plated Gage Blocks



14 STANDARD SIZES OF UNIVERSAL JOINTS

FROM 4" TO 3/8" DIAMETER

offering modern industry a real advantage in having universal joints, of the highest quality, available for immediate shipment.

This wide range of sizes — with either solid or bored hubs — fits most universal joint needs — from instrument controls to heavy duty steel mill applications.

Curtis makes universal joints exclusively and their 25 years experience is yours to command. Special machining for specific applications is done before assembly — saving money and insuring accuracy.

Send us your universal joint problems, indicating speed, angle of operation and torque load, with blueprints if possible. There is a Curtis Universal Joint immediately available to you — whether for a heavy duty 4" installation or a high-speed light duty job.

WRITE DEPT. B-3

CURTIS UNIVERSAL JOINT CO. INC. SPRINGFIELD

introducing

the new AIRCO No. 3 MONOGRAPH

gas shape-cutting machine

Another addition to Airco's extensive line of gas-cutting machines will be coming off the production lines very shortly—the No. 3 Monograph, an inexpensive, portable, oxyacetylene shape-cutting machine.

The new No. 3 Monograph, lowest priced machine of its type (only $695, including a manual tracing device, torch, tip, tubular rail, hose and carrying case) will cut steel up to 8" thick in most any shape. Its cutting area is 32 inches by 4 feet 8 inches, and with the addition of 6-foot 8-inch rails, the length of the cutting area can be extended as desired.

Further, in addition to regular shape cutting, this new machine will also handle straight line, circle and bevel cutting jobs—all with a high degree of accuracy.

The Airco No. 3 Monograph is *portable*—the machine itself weighs but 110 lbs. and the tubular rail 35 lbs. The entire unit is packed in a carrying case which can be conveniently handled by two men.

SPECIAL TRIAL OFFER
(Good in Continental U. S. A. Only)

If you would like to try this machine for two weeks in your own shop on your own work, just drop a letter to your nearest Airco office or authorized Airco dealer and they will advise you how this can be arranged. If you would like a descriptive folder (ADC-660) about this unique, new shape-cutting machine, please fill out and mail the attached coupon.

priced at only

See one of the first Airco No. 3 Monographs in operation at Booth No. 2126, National Metal Show, Cleveland, October 17th to 21st, 1949.

AIRCO **AIR REDUCTION**
New York 17, N. Y.

Please mail your folder (ADC-660) describing the Airco No. 3 Monograph.

Name_____

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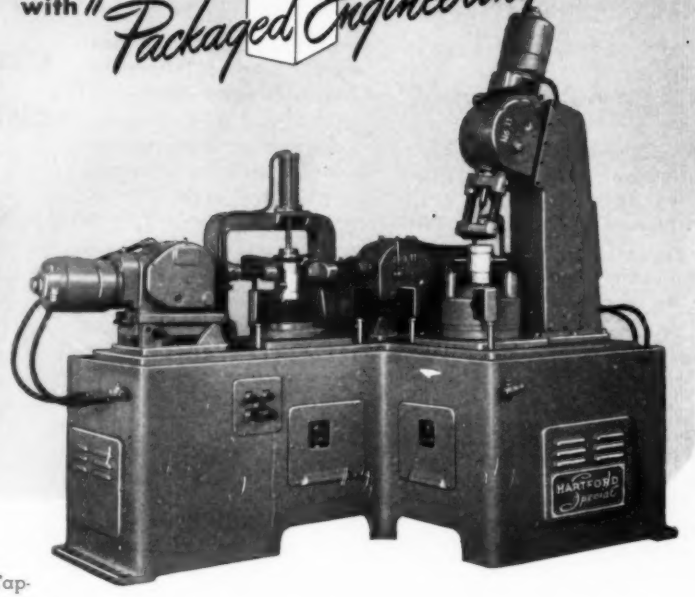
Give production a prod

with "Packaged Engineering"

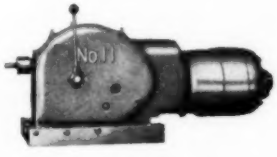
featured in all Hartford Special "LANGELIER"

AUTOMATIC DRILLING & TAPPING MACHINES



Hartford Special Drilling and Tapping Machines are built to do a lot of producing in a limited amount of space. All the factors that are considered by Hartford Special Engineers in planning a job have been refined to make every second and every fraction of an inch count, and to leave as little as possible to the skill of the operator. Such timesaving devices as automatic clamping fixtures as well as safety features like twin start-stop buttons all come as a bonus with the "packaged engineering" that Hartford Special has to offer. If you are looking for a special single-purpose machine to put your production out ahead, write our Engineering Department now. The Hartford Special Machinery Company, Hartford 5, Conn.

The horizontal heads of this machine drill 6 sets of opposed holes irregularly spaced, while the angular head drills 12 holes. Pieces are clamped, indexed, drilled and unclamped . . . all automatically.



Automatic Unit
No. 11 & 31

Lead Screw
Tapping Unit
No. 12 & 22

The spindles of all units are of alloy steel, heat treated and ground, mounted in anti-friction bearings. All gears are of heat treated alloy steel. Dovetail adapter plate with screw adjustment permits quick and accurate positioning.

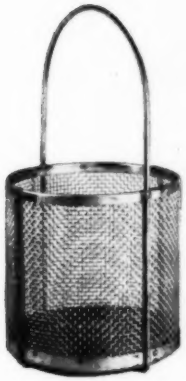
HARTFORD Special

. . . the standard for special machinery

ROLOCK

HEAT AND CORROSION RESISTANT

FABRICATED ALLOYS



Two Dipping Baskets that can "take it"

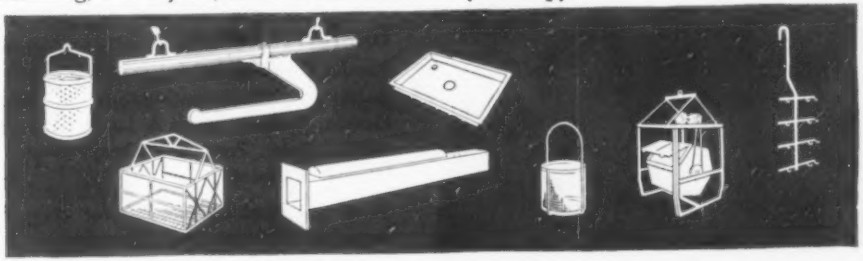
Regardless of what you pay for hand dipping or cleaning baskets their value is measured only by hours of service. Rolock welded fabrication . . . plus our own woven wire mesh, extends basket life, cuts finishing costs.

Rolock Style AO—recommended as most serviceable design for high nickel chrome alloy baskets. Strong, safe to handle, highest resistance to heat and corrosion. Mesh can easily be replaced when worn.

Rolock Style 1W—welded basket of a thousand uses. Seven types of handle variations available. This is but one of many styles, sizes and alloys, assembled to order for fast shipment. No finer baskets made.

ROLOCK CATALOG WILL HELP YOU TO CUT COSTS

More than 200 custom-built designs of fabricated-welded, corrosion and heat resistant items shown. What we've built for others may be what you need for better finishing, less rejects, lower costs. Write for your copy.



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JOB-ENGINEERED for better work
Easier Operation, Lower Cost

VISIT US AT **BOOTH 820**
Metal Show, Cleveland, Oct. 17

12RL49

HARDINGE
ELMIRA, N.Y.

PRECISION COLLETS *for* ALL MACHINES

Hardinge Collets for Lathes

American, Ames, Boye & Emmes, Carroll & Jamieson, Chard, Cincinnati, Cisco, Elgin, Greaves-Klusman, Hamilton, Hardinge, Hendey, Jones & Lamson, LeBlond, Monarch, Porter Cable, Pratt & Whitney, Rahn-Larmon, Reed-Prentice, Rivett, Rockford, Sebastian, Seneca, Sheldon, Sidney, South Bend, Springfield, Stark, Sundstrand and Van Norman. Collets for all sizes of Cushman Chucks and Hardinge-Sjogren Speed Collet Chucks.

Hardinge Collets for Millers

Ames, Becker, Burke, Elgin, Hardinge, Kearney & Trecker, Pratt & Whitney, Reed-Prentice, Rockford, Stark, Sundstrand, Van Norman.

Write for Bulletin No. 48 for complete ordering information, dimensions and prices.

For Automatic Screw Machines

Hardinge Collets, Feed Fingers, Master Collets, Master Feed Fingers, and Pads for Automatic Screw Machines, Brown & Sharpe, Cleveland, Cone, Davenport, Greenlee, Gridley, Acme-Gridley, National-Acme, New Britain.

For Turret Lathes

Hardinge Collets for Turret Lathes—Acme, Bardons & Oliver, Cincinnati-Acme, Foster, Garvin, Gisholt, Jones & Lamson, Logan, Morey, Oster, Pratt & Whitney, Simmons, Warner & Swasey.

Write for Catalog No. 36 for complete ordering information, dimensions and prices.

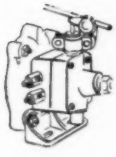
ONE SOURCE OF SUPPLY — STANDARD SIZES IN STOCK FOR PROMPT DELIVERY

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

Offices in principal cities. Export office 269 Lafayette St., New York 12, N. Y.

HOW THE BELLOWS AIR MOTOR *differs from* CONVENTIONAL AIR CYLINDERS

Bellows double-acting non-rotating BM-15 Air Motor



Quick, positive directional valve is an integral part of the cylinder

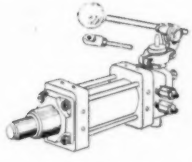
Speed control valves, also built-in, provide accurate control of traverse rate

Only one air connection required, which can be flexible hose

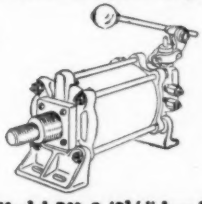
The Bellows Air Motor is a *different type of air cylinder.* It is a compact, reciprocating power unit, complete in itself. No extra directional valves or speed control valves are required. All controls are integral with the cylinder itself.

Its compactness, its simplicity of installation and operation, make practical the use of flexible, economical, "controlled-air-power" in an unlimited range of fundamental pulling, pushing and lifting movements.

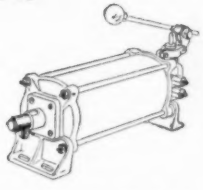
Four Power-rated Sizes
Manual, Mechanical, Electrical Valve Operation
All Standard Mounting Types • Standard Stroke Lengths 1" to 48"



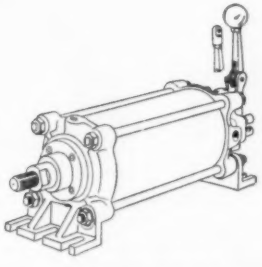
Model BM-1 (1¼" bore)



Model BM-5 (2½" bore)



Model BM-10 (3⅝" bore)



Model BM-15 (4½" bore)

Write for Bulletin BM22 and the new Foto Facts sheets showing cost-cutting installations of Bellows "Controlled-Air-Power" Devices. Address Dept. AM-1049.

The Bellows Co.
AKRON, OHIO

. . . to suit your every need!

Do you make rivets . . . other cold-headed products? Do you need quality copper-alloy wire to be headed, extruded, drilled, or redrawn? Do you need wire of a certain degree of hardness, malleability?

Have you read the headline of this ad? Then you know the answer!

Come to Chase. Chase service, Chase quality . . . is just what you've been looking for. The word quality here means many things . . . freedom from physical defects . . . uniformity of surface texture and color . . . accuracy of dimensions . . . precise adjustment of temper and control of grain size.

Come to the nation's headquarters for brass and copper. Call your nearest Chase Warehouse or Service Office today!

Chase

the Nation's Headquarters for
BRASS & COPPER

WATERBURY 20 CONNECTICUT

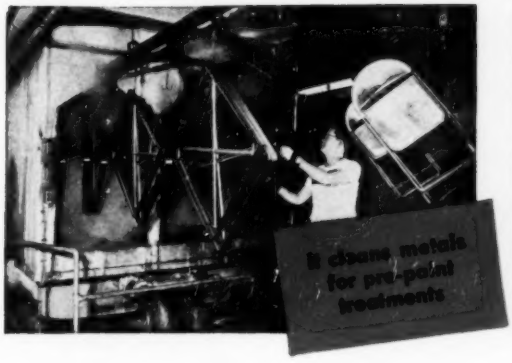
SUBSIDIARY OF KENNECOTT COPPER CORPORATION

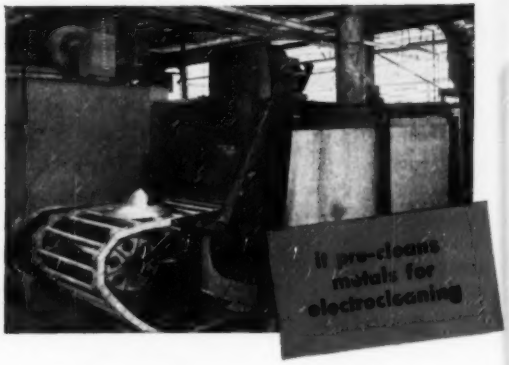
THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DALLAS DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† ST. LOUIS SAN FRANCISCO SEATTLE WATERBURY (†Sales Offices Only)

introducing . . .

OAKITE COMPOSITION No. 97





Oakite announces the new, self-emulsifying solvent material, *Oakite Composition No. 97* for use in your spray-washing machines.

Diluted in water, *Oakite Composition No. 97* efficiently washes aluminum and zinc die castings, steel, brass and other metals. Emulsions of *Oakite Composition No. 97* speedily wet and dissolve the grease binders in buffing, drawing, cutting, grinding compounds and shop soils. Its surface-active agents then quickly penetrate and loosen deposits for thorough rinse-away.

Used as recommended it does not foam. Solutions have long life because soils are not held in permanent suspension. When necessary simply skim off soils. *Oakite Composition No. 97* also produces film on work surfaces to discourage corrosion. Is fire-safe. Use it, too, in rinse water to minimize danger of water spotting.

If you want to know how Oakite Composition No. 97 can fit into your production line, contact the Oakite Technical Service Representative in your territory. Arrange for a demonstration.

OAKITE PRODUCTS INC., 26 Thames St., NEW YORK 6, N. Y.
Technical Service Representatives in Principal Cities of U. S. & Canada

big features:

- economical
- no rust
- no foam
- no fire
- no toxic fumes

applications:

- auto frames
- bolts
- brake drum parts
- gears
- heater shells
- machined castings
- window frames

OAKITE

MATERIALS
METHODS
SERVICE

Specialized Industrial Cleaning

ANOTHER
"Preference-Proof"
STORY:

NORMA-HOFFMANN PRECISION BEARINGS

Norma-Hoffmann Bearing equipped Black & Decker ½" Standard Drill

Provide Smooth Operation and Give Long-Life in
BLACK AND DECKER PORTABLE TOOLS

SINCE 1918 Black & Decker Engineers have been using Norma-Hoffmann Precision Bearings in many of their portable tools for their exceptional long-lived, dependable performance.

A typical application example is the "B & D" ½" Standard Drill, illustrated, in which three Norma-Hoffmann Bearings are used. Commutator and fan end of the armature rotate on single felt seal shielded bearings...and the chuck spindle is carried on a double felt sealed bearing. Armature speed is 16,800 RPM . . . full load spindle speed is 275 RPM.

Manufacturers of other equipment from electric motors to machine tools, can also benefit with the use of Norma-Hoffmann Precision Ball and Roller Bearings. Their dependability, friction-free smoothness and quietness of operation improve design and performance of products wherever they are used. A wide range of types and sizes makes selection easy.

Norma-Hoffmann Field Engineers will gladly help you with your bearing problems. Write for their assistance.

NORMA-HOFFMANN BEARINGS CORPORATION
STAMFORD, CONNECTICUT

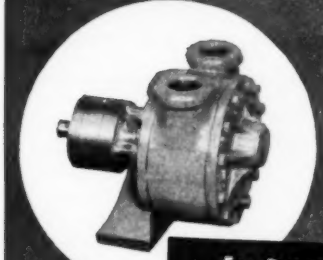
Above — Single felt seal shielded ball bearing

Left — Double felt seal ball bearing

NORMA-HOFFMANN *Precision* **BEARINGS**
BALL • ROLLER • THRUST

Field Offices: Chicago, Cleveland, Detroit, Cincinnati, Los Angeles, San Francisco, Dallas, Seattle, Phoenix.

SPECIFY THIS COMPACT TUTHILL PUMP

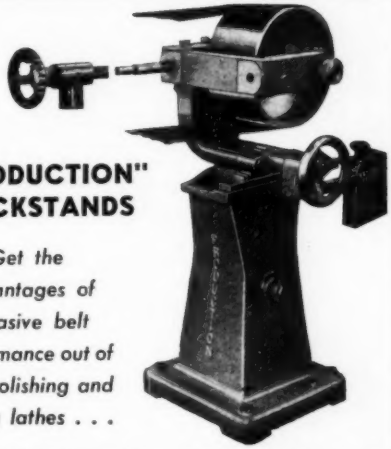


For Dependable High Pressure Service

This Tuthill Model C K pump is designed to save space, material and money in high pressure service on machine tools, engines and hydraulic devices. Available in capacities up to 50 g.p.m. and pressures up to 400 p.s.i. Direct motor drive, V-belt units and integral drives. Write for Model C K bulletin.

TUTHILL PUMP COMPANY

939 E. 95th Street, Chicago 19, Ill., Phone REgent 4-7420



"PRODUCTION" BACKSTANDS

Get the advantages of abrasive belt performance out of your polishing and buffing lathes . . .

This "PRODUCTION" development makes it a simple matter to convert your polishing and buffing machines to the abrasive belt system and assure highest precision and maximum convenience in operation.

Belts up to 6" wide and 14' long can be accommodated. Constant belt tension is provided as well as means for adjusting belt tension.

Timken bearing equipped. Contact wheels 6" to 16" diameter can be used.

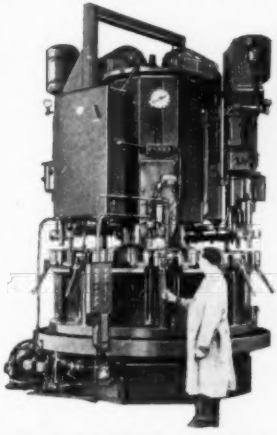
Write for detailed descriptive literature.

Production MACHINE COMPANY GREENFIELD, MASSACHUSETTS, U.S.A.

How to Combine Machining Operations in Less Floor Space

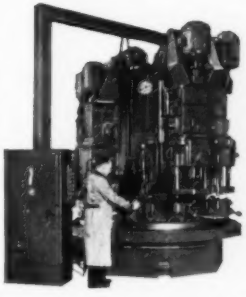
Here are two interesting examples of high production machining in relatively small floor space. Rather than string each operation out in a long line with conveyors, the operations are performed in fixtures held on a rotary indexing table.

5 OPERATIONS ON 240 PARTS PER HOUR IN 79 SQ. FEET . . .



This type VSI vertical indexing drilling machine is designed for drilling, reaming and chamfering five bolt holes and drilling and chamfering one 18" hole in automotive rear axle.

4 OPERATIONS ON 130 PARTS PER HOUR IN 84 SQ. FEET



This type VSI special vertical automatic indexing machine is provided with eight two station fixtures for holding one each right and left hand spindle assembly supports. Operations include drilling, reaming, chamfering and sawing. While each head is hydraulically actuated, on the machine illustrated, electrical mechanical heads are also available.

Write for free additional information today. Ask for bulletin 160.

DAVIS and THOMPSON CO.

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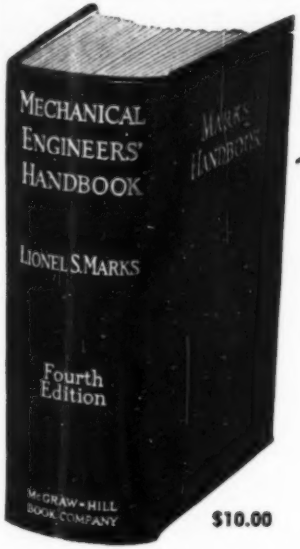

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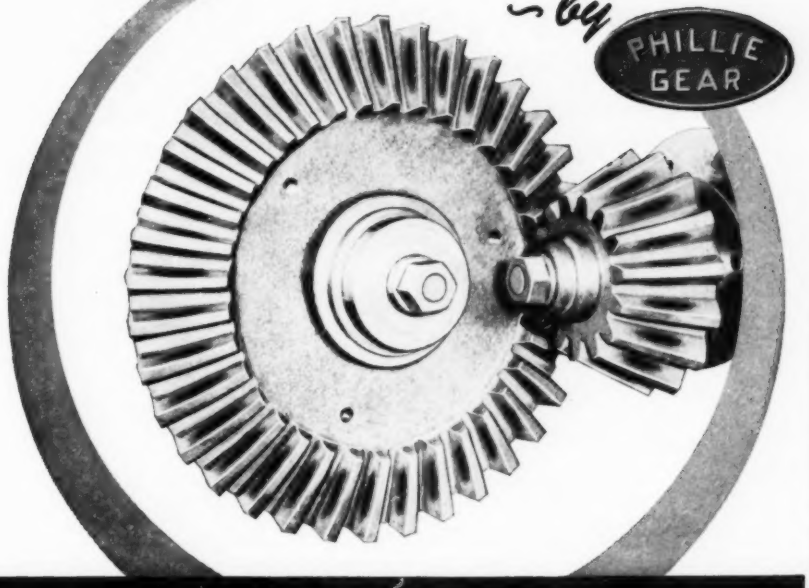

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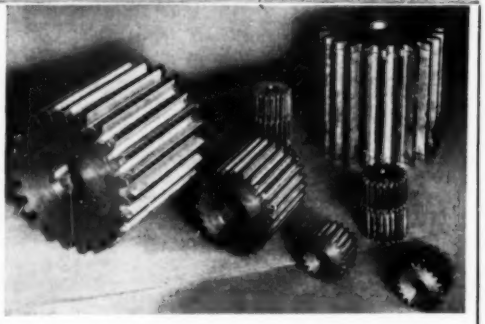

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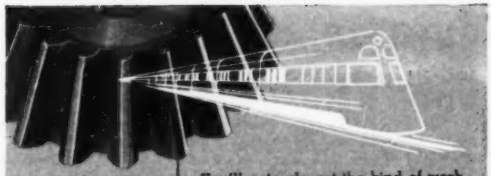

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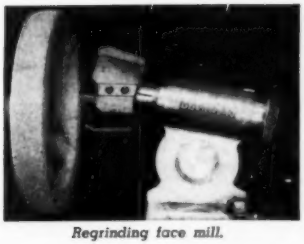
The Madison fixture is graduated in all three planes and offers 180° automatic indexing for resharpening Madison cutters and which can be released for conventional handling of other types of tools.

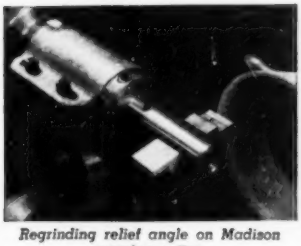


Regrinding face mill.

Grinding trailing angle and relief on tool bit.

Regrinding face of end mill.

Resharpening spiral milling cutter.



Regrinding relief angle on Madison reaming cutter.

Grinding lead angle on Madison roughing cutter.

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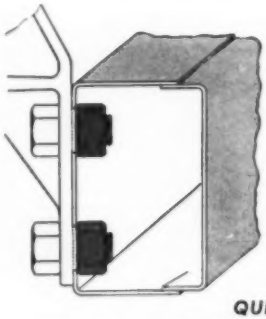

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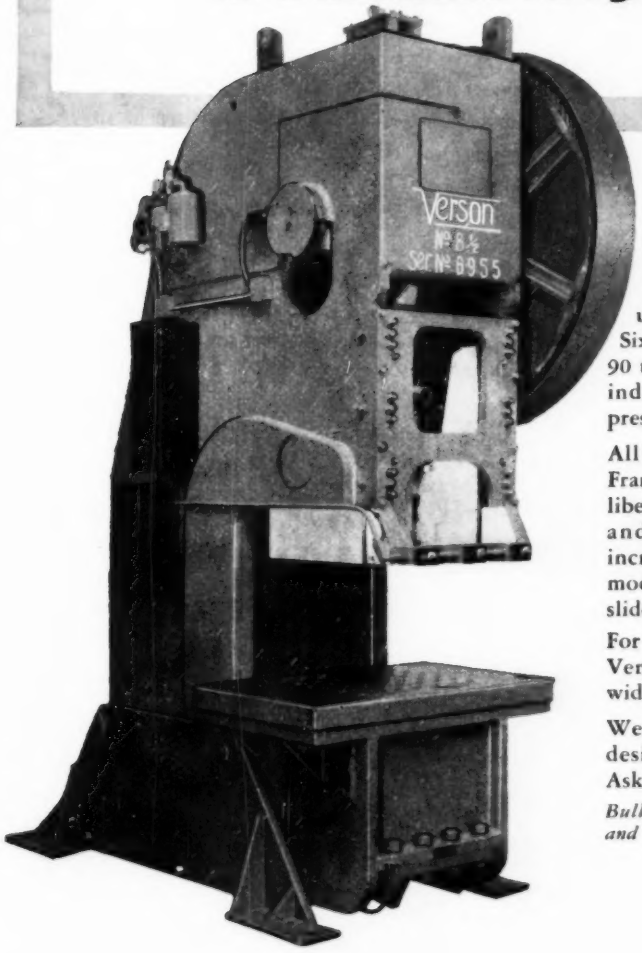

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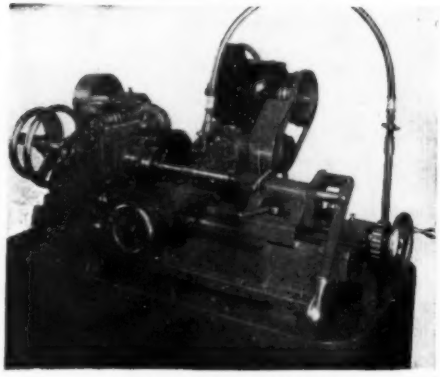

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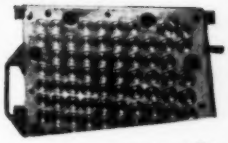

80 cavity male Speed Case rubber mold. Machining costs lowered 41%.

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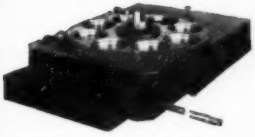

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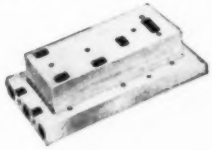

Carburized and hardened Speed Alloy mold, with hobbed cavities, made by W & L Molding Co., Kalamazoo, Mich. Note mirror finish.

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This newly developed electric index fixture offers many important time and cost saving possibilities. With it almost any drill press, tapper or similar machine can be fitted for precision indexing. It provides its own drive through an integrally-built electric motor. Synchronization of the indexing with the vertical movements of the machine's spindle is also accomplished electrically.

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WRITE FOR BULLETIN No. 97— IT'S FREE!

It has full information and prices on these new production-boosting Indexing Fixtures.

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DRILL & TAP CHUCKS • TAPPING ATTACHMENTS
MULTIPLE DRILLING & TAPPING HEADS
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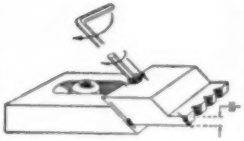
SAVE TIME AND MONEY

with these new side-gripping Self Locking

Jaw Clamps



J & S Jaw Clamps hold all sizes and shapes of work-pieces tightly against face plates of machine tools. Clamp is self-locking and full surface of work 3/8" high or over may be machined without interference, because the jaws grip the work-piece on the sides. These Clamps facilitate controlled centering adjustment—secondary operations are unnecessary—they eliminate different length studs and blockings—tested for two-ton down pressure. Send for details.

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• The Barrett Parts Drying Process centers around a method of creating a guarded cyclone.

In operation, parts to be dried are placed in a well ventilated motor driven rotating basket. Free liquid is immediately thrown off by centrifugal force and any moisture remaining on parts is absorbed in the shortest possible time by the large volume of expanded air continually forced over and through the contents. Provision is made for heating and expanding, also boosting the flow of incoming air to assure faster absorption of moisture. With the large exhauster provided, heated air is not always required.

Direction of basket rotation can be quickly reversed which will change position of the load and accelerate drying. Baskets are available in shapes which experience has shown to be most effective for handling various classes of work.

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Full Details of the Barrett Cyclone Dryer Sent Promptly on Request.

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That's not so difficult as it sounds. Whether you're working on tiny pieces or 30" x 3" bars, you'll get better results from your surface grinders when they are equipped with Robertson Cool-Cut Wheels. Time and time again, Robertson Wheels have demonstrated their ability to cut grinding time in half—*or better.* For instance:

This manufacturer was grinding hardened and soft steel stock on a Mattison surface grinder to a required finish of 15 microinches. With a conventional grinding wheel, it took one hour and 30 minutes to do all four sides. When he switched to a 20" x 6" x 10" WA 362-IVC Robertson Wheel, this time was reduced to 45 minutes. Stock removal averaged .030" to .035". Table speed was reduced to 40 feet per minute and cross feed to the lowest position.

In addition, the Robertson Wheel required less truing than the conventional wheel and did its job with little or no wear.

An increase of 100 percent in productivity . . . and at lessened wheel costs!

Results like these are not rare, but are being achieved daily with Robertson Wheels in machine shops all over the country. It will pay you to find out how much more, and better, work Robertson Cool-Cut Wheels can do for you. Send for your free copy of the interesting pocket booklet "How to Buy Production Time."

ROBERTSON MANUFACTURING COMPANY
TRENTON 5, NEW JERSEY

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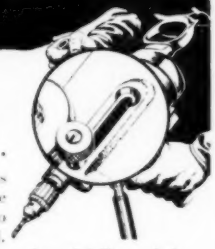

Gear Shift . . .

permits change from low to high speed.

reduces number of drills needed.

operates from 1/4" to 5/8" in steel; 1/4" to 1 1/4" in wood.

combines speed and power in one drill.

A 3/8-5/8 INCH HEAVY DUTY FULL-BALL BEARING DRILL

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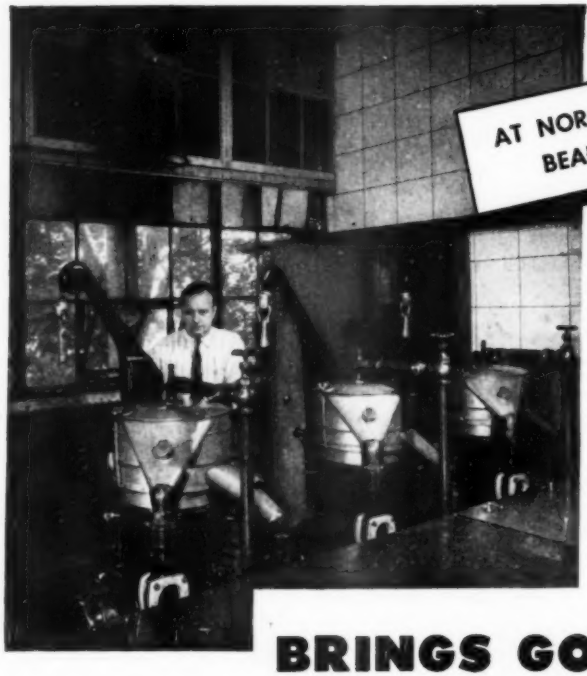

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De Laval Oil Purifiers continuously remove all contaminants from the oil that washes extra-silent Norma-Hoffmann "Precision" bearings. After a jet of oil has thoroughly cleaned the surface of the bearings, this oil is restored to "like-new" usefulness by centrifugal force.

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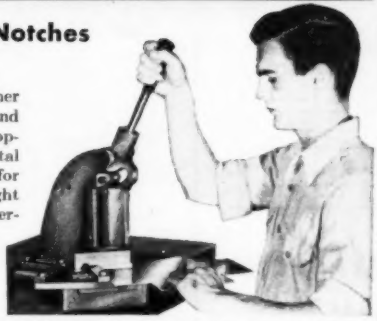
The new precision DI-ACRO Notcher eliminates the need for punch press and dies on many production notching operations. It is also ideal for experimental work as it can be quickly adjusted for any size or shape notch. Many straight shearing operations can also be performed with this flexible unit.



CUTS CLEAN—NO BURRS OR ROUGH EDGES

The powerful DI-ACRO Notcher has an exclusive roller bearing cam design which provides a tremendous pressure with a small amount of effort. The precision-ground Vee-shaped ram and blades of alloy tool steel assure clean cuts and permanent accuracy.

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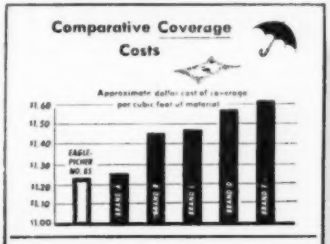

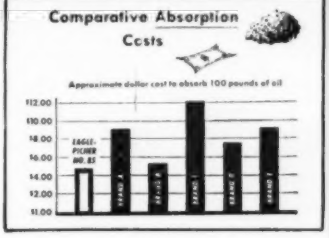

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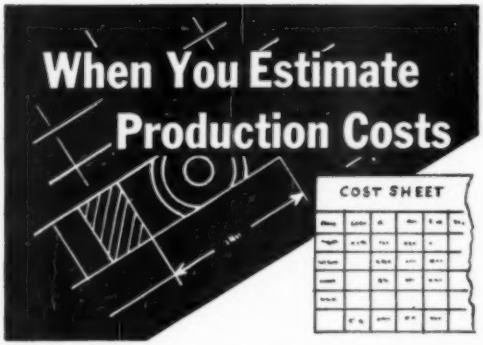

How Much Do You Allow for VIBRATION?

Where plants have vibration problems of any kind, production costs are higher than they need to be.

Don't ask your accountant for verification of this fact—ask your production men who have to get the work out on time so that it passes inspection.

Vibration Control can help shave costs of Labor, Materials and Overhead, and although the individual savings may seem too *small* to bother with, they can add up to a total too *important* to be overlooked—with competition the way it is today. For instance,

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Vibration causes excessive machine wear. Control vibration and your operators spend more time producing—less time watching the machine being repaired or adjusted.
Vibration often limits machine speeds. Control vibration and you step up the speed.
Vibration from punch presses, hammers and other disturbers has often led to the practice of segregating them. Control vibration, and you get a better plant layout, with machines where they belong for straight line work flow—and you save on materials handling costs.

MATERIALS—Vibration transmitted from other machines can seriously impair the quality of work in process on rigidly mounted grinders and other precision machine tools. Control vibration by isolating the vibrating machine or the precision tool, and you reduce rejects and work spoilage.

OVERHEAD — Vibration requires extra maintenance of plant and equipment, and decreases useful machine life. Vibration control will keep these costs down.
Vibration often increases costs for foundations and floor construction. Vibration control, properly engineered, can often reduce or entirely eliminate foundation requirements—or permit lighter floor construction. It frequently makes it possible to install impact machinery on upper floors.
Vibration often causes neighbor trouble and complaints from adjacent departments or tenants. Vibration control can iron out the objections.

Korfund Vibration Control is neither complicated nor expensive. In a half century of service to industry, we have developed a wide range of materials and methods which will give the required degree of isolation at minimum cost. During this time we have successfully isolated all types of equipment from office machines to hammers weighing more than a million pounds, from small motor-generator sets and laboratory equipment to 1500 hp diesels.

If you would like to have us apply this experience to help you decide whether vibration control is worthwhile for you, give us the type, make and model number of the equipment which is causing you trouble, and we will give you facts and figures—without obligation.

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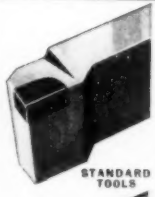
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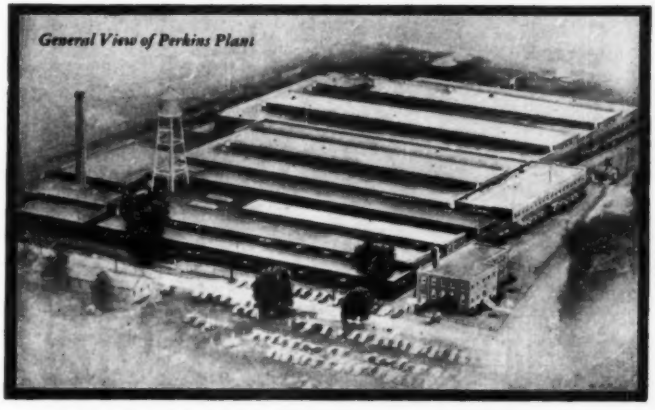
General View of Perkins Plant

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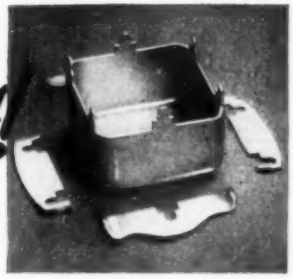

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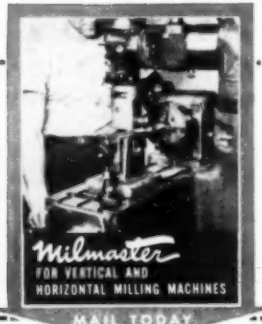

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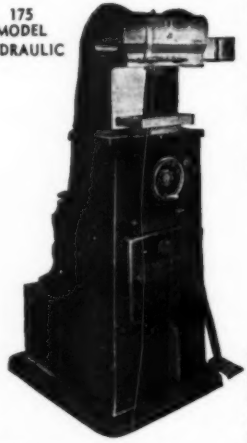

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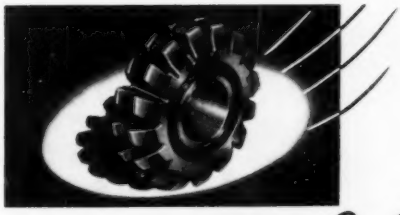

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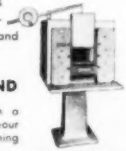

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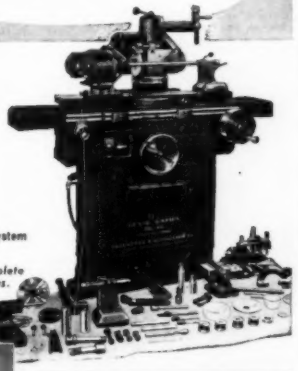

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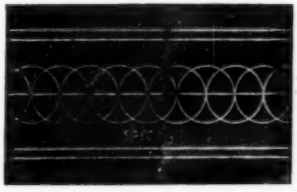

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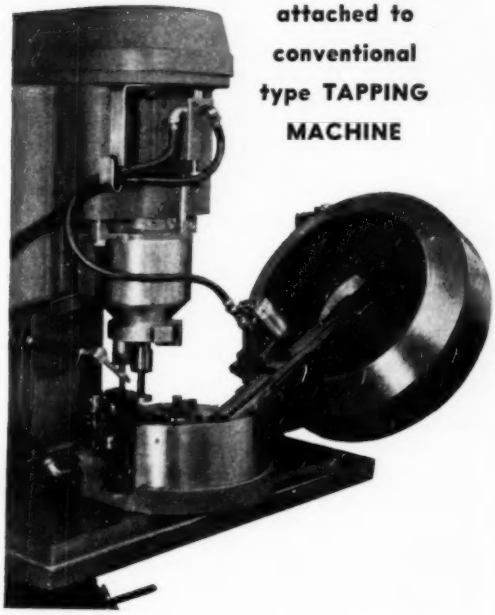

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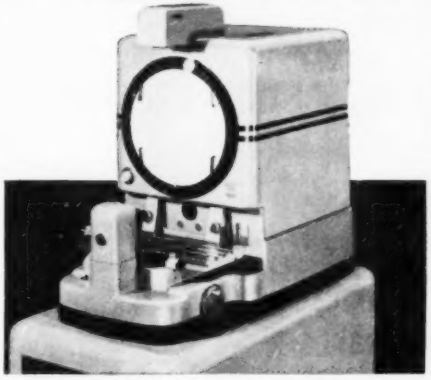

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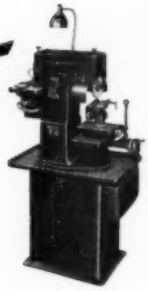

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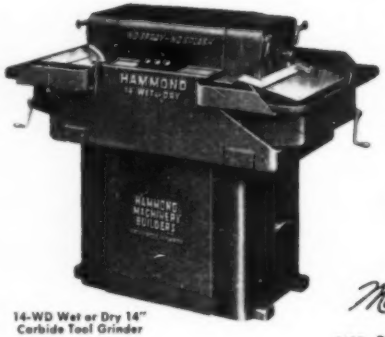

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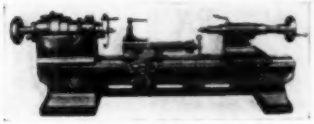

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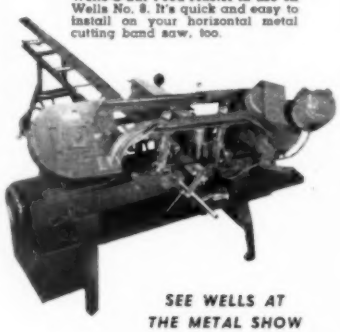

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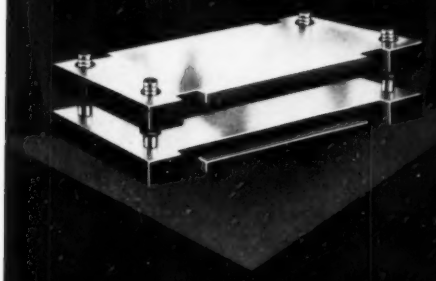

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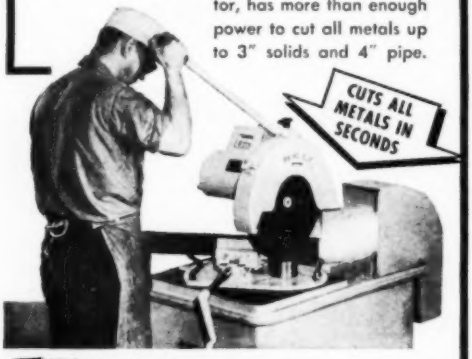

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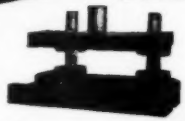

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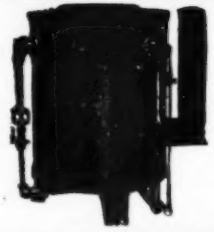

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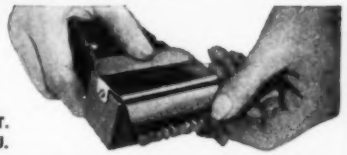

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(Continued on Page 268)

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No. 11 Brown & Sharpe Self-Contained, m.d.
10x18" Landis Type C, m.d.
10x24" Landis, m.d.
10x36" Cincinnati Hydraulic, m.d.
10x48" Brown & Sharpe, belt
10x72" Brown & Sharpe, belt
10x72" Landis, m.d.
12x36" Landis, m.d.
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16x48" Landis Type D, m.d., latest
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12x48" Cincinnati Hydraulic, m.d., latest type
12x48" Norton, m.d., latest
16x24" Cincinnati Self-Contained, m.d.
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MILLER—Plain K. & T. #4K, Late
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Clearing—200 Ton (1943)
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ROLLS—Bending 36' x ¾" Pyr., 10' x ½" Pyr., 11' x ¾" Initial.

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Bullard 12" 6-spdl. MULT-AU-MATICS (2)
10"x48" Norton "C" Plain Grinder
#16-Y-28 Bryant Internal Grinder
#725 Fellows Gear Shaper
#3MS Cincinnati Plain Miller
#5H Kearney & Trecker Plain Miller
13"x30" Pratt & Whitney Model "B" Lathes

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Nos. 3 & 2MH Cinci. Pl. Dial Millers, late
Nos. 3K & 3H K. & T. Pl. Dial Millers, late
No. 36 Van Norman Pl. Miller, ram, '43
No. 2G Kempsmith Univ. Miller, 1943 (3)
No. 2416 Keller Duplicator, late
No. 9J Gorton Duplicator & Vert. Miller (2)
Bridgeport Vert. Miller, slotting (3)
12"x24" G. & L. No. 45 Surface Grinder, '42
No. 70A Heald Internal Grinder, 1942
Gear Cutter, No. 13 B. & S., spur & bevel
No. 6 M. & M. Keyseater, AC. M. D.
61" Bullard Maxi-Mill Vert. Boring Mill

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Industrial washing machine—for washing and blowing off small metal parts—capacity 750# per charge—production cycle approx. 10 minutes—solution tank heated by steam coils—centrifugal pump in wash unit 7½ HP motor—centrifugal blower 3 HP motor—electrical equipment 440 volt, 3 phase, 60 cycle—dimensions approximately 13'6" long, 4'6" wide, 7'9" high.

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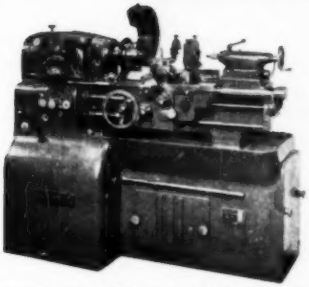

10"x20" Model #EE Monarch Precision Toolmakers Lathe. Late Type. W/Taper Attach. Collets, chucks, toolholders, tool cabinet. Immediate shipment.

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Bardons & Oliver #1 Electric Turret Lathe. ¾" cap. Has bar feed & collets.
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Simmons Microspeed 1" Cap., M. Dr.
Oster #601 Hand Screw, Machine 1½" cap.
W-Swasey #4 Univ. 1½" cap., M. Dr.
Jones & Lamson #3 Univ. Bar Feed 1½"
W-Swasey #3 Univ. 1½" cap., M. Dr.
Bardons & Oliver #7, Univ. 2½" Cap.
W-Swasey #3A Univ. 3½" cap., M. Dr.
Warner & Swasey #1A Universal Heavy Duty Saddle Type Turret Lathe. Serial #648220. Capacity—2½" rd., Grd. Hd. 12 speeds. Coolant system, bar feed, chuck & tooling. Immediate delivery. Excellent condition. Hydraulic Speed Selector.

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24"x16' American Q.C.G. Motorized Cone Head. 11' centers. Taper Attachment 24" chuck, faceplates, cabinet type legs. 220/440 volts motor
.0"x10' American, Q.C.G. 72" centers.
20"x10' Hendey Motorized.
20"x8' Lodge & Shipley. Q.C.G. M. Dr.
18"x8' Davis Q.C.G. 42" centers, equipment.
18"x8' Lodge & Shipley, geared head.
18"x6' American, Geared Head, M.D.
18"x6' Monarch 8-Speed hd. Q.C.G. 220 volts motor. Actual swing—20¼". 20" c.c. Hex. Turret on crosslide. Cabinet legs.
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16"x6' Monarch 8-Speed Hd. Q.C.G. 220 volts motor. 24" c.c. Univ. Chuck, Draw-bar & set of 16th collets and 32nd collets.
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BETTS 100" Special Vertical Boring and Turning Mill. 1944 Machine. 2 Plain Heads. Complete electrical equipment. Excellent condition. Immediate delivery.

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Mattison 12" x 16" x 48" Motor Driven Precision Hydraulic Horizontal Surface Grinder. Serial #13025. Excellent condition. 220/440 motors. W/12" x 148" Chuck & G.E. Generator. Built-in push button controls. ONE AVAILABLE.

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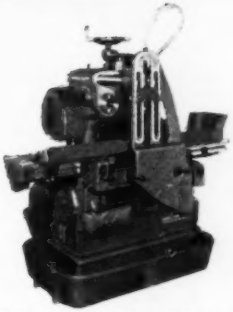

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Milwaukee #3K Vertical, M. Dr. Dial Type.
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Milwaukee #3B Plain Horizontal.
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Model #2L Cincinnati Universal. Serial #9A2U1J —102.15 speeds, 12 feeds. 220 volts motor in base.
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Kempsmith #2, 28"x8½"x18".
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Some w/index heads & equipment.

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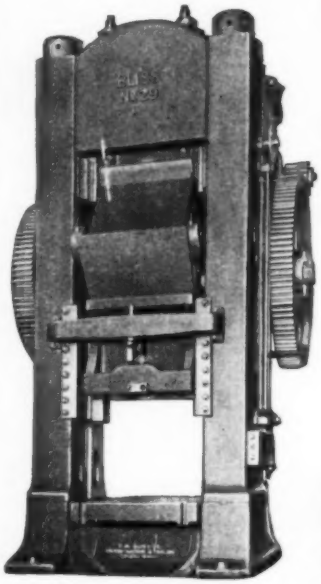

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STROKE	5 "	. . .	6 "
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Niagara 10' x 16 Ga. Power Squaring Shear, Serial No. 39586, practically new.
Price $2,500.00
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517 Delaware St., Indianapolis 4, Ind.

POWER PRESSES

BLISS TOLEDO V & H TYPE
REBUILT — GUARANTEED

MINA MEMBER

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Tioga, Livingston and Almond Streets
Philadelphia, Pa.

A LIST OF GOOD HIGH GRADE MACHINE TOOLS

BORING MILLS

Horizontal and Vertical

2½" No. 25T Giddings & Lewis
3" No. 3A Universal
3¼" No. 3Z Lucas table type
3¾" No. 5A Defiance table type
5" bar Jones planer table type
100" Niles Bement Pond. Extra heavy Pattern vertical.
52" King vertical
Vernon vertical jig borer
No. 2 Pratt & Whitney vertical jig borer
No. 112B Ex-Cell-O single end single spindle borer
No. DB2112 Ex-Cell-O precision borer, single end, double spindle
No. 42 Heald Borematic borer
No. 47A Heald Borematic
No. 48A Heald Boremastic
Natco 1-way horizontal borer or driller
No. 4HH Baker 2-way with multiple heads
Munson double end boring, drilling and tapping machine

COMPRESSORS

355 cu. ft. 12"x10" Ingersoll Rand
311 cu. ft. 12"x8" Ingersoll Rand Type ERI
92 cu. ft. 7"x6" Ingersoll Rand type ERI

DRILLS, RADIAL

3'arm 10" column Morris
4' arm 11" column Cincinnati Bickford universal
4' Hammond Type G elbow arm
4' Hammond Type D elbow arm
6' arm 15" column Dreses
Walker Turner radial drill with swivelling head

DRILLS, SENSITIVE

24" No. 4B Edlund power feed
24" Allen 4-spindle Type 2KH
24" Foote Burt 6-spindle with motors
24" Domco 4-spindle Model KTV
18" No. 18 Canedy Otto. new
15" Avey No. 2 Type AD
10" Allen 6-spindle

DRILLS, MISCELLANEOUS

Detroit 5-spindle horizontal
Baush horizontal 2-way multiple
Barnes 2-spindle horizontal deep hole
Natco 1-way horizontal hydraulic
No. 15½ Foote Burt hydraulic
No. 30HO Baker hydraulic, inverted type

GEAR MACHINERY

Nos. 8H, 12H, 16HS Type B Gould & Eberhardt gear hobbers.
No. 6 Fellows gear shaper
Nos. 3 and 12 Barber Colman gear hobbers
Model T Barber Colman spline mill and gear hobber
8"-10" No. 1 Loos Bradner gear hobber
14"x8" No. 5A Lees Bradner gear hobber
Model 130 Cleveland Rigidhobber
No. 5M Adams gear hobber
24"x12" Flather gear cutter
18" Gleason bevel gear testers
18" Gleason bevel gear testers or lappers
18" Gleason combination testing and lapping machines
8" Red Ring gear lappers
Red Ring 3-spindle lapper
8"-12" Red Ring gear shaver
Lipe 2-spindle gear tooth rounder
National Tool Co. Model B gear checking machine
No. 4 Cimatool Peerless gear tooth rounder
Barnes "Mall" Hut-O-Lap gear lapper
12" Gleason gear generator
18" Gould & Eberhardt gear hobber

GRINDERS, DISC

20" No. 226 Gardner double disc
53" No. 372 Besly vertical spindle horizontal
30" No. 86 Gardner horizontal
15" No. 115 Gardner opposed spindle
No. 214 Hanchett opposed disc
50" No. 230 Hanchett Type BD opposed disc
Nos. 00 and 1 Osterheim disc

GRINDERS, SURFACE

No. 10 Blanchard
No. 23A Heald rotary, 10" and 24" dia. chuck
No. 22 Heald rotary
6"x18" No. 2B Brown & Sharpe
8" Pratt & Whitney vertical spindle rotary
14"x36" Pratt & Whitney vertical spindle
8½"x20" No. 3 Wilmarth & Morman
8"x22" No. 3 Abrasive
8"x24" No. 7B Wilmarth & Morman
8"x24" No. 34 Abrasive vertical spindle
14"x60" Mattison
24"x48" Springfield planer type

FORGING EQUIPMENT

2" National
4" Ajax
5" Ajax
No. 30 Waterbury Farrel ODSS cold header
No. 1 Ajax taper forging roll
No. 18 Kane & Roach straightening rolls

MISCELLANEOUS

36" Tannewitz band saw
Logemann hydraulic scrap baler
7 cu. ft. Pangborn rotoblast
Model 28-18 American Type C crusher
No. 302 Campbell abrasive cutoff machine
Pratt & Whitney Keller engraver or die sinker
No. 3 Baker keyseater
No. 193-4 Milwaukee jolt squeeze and strip machine
No. 11 Murchey pipe threader
No. 12B Pratt & Whitney profiler or vertical mill
No. 6HS-9 Langelier swager

MILES MACHINERY CO.
SAGINAW, MICHIGAN

A FEW MACHINES FROM OUR LARGE STOCK

AUTOMATICS

Brown & Sharpe #00G, H.S., #4, #6, #2G
Conomatic 8 sp. 1⅞" cap., 6SP—2¾" cap.
New Britain Gridley 6I—8 Sp. 2¼"

BORING MILLS

Giddings & Lewis #8, #25T, Bullard, 42" V.T.L.
Universal 3" horiz., Lucas #31 horiz.

DRILLS AND RADIALS

Canedy-Otto 3'-9" col.
Carlton 8'-19" col., Foote-Burt 6 Sp.
Cinci-Bickford Super-Service 21", 24"
Natco Model E-5 Multi-Spindle, 14 spindles
Sibley 24—28", Allen 6 Sp., Excelsior 21"

ENGRAVERS

Gorton #3U, 3Z, 3L; Deckel GI, GIF
Gorton Cutter Grinders 375-2, 265-5

GEAR EQUIPMENT

Fellows #72, 725 High Speed, Mikron Gear Hobber
Michigan, Gleason, Fellows Checkers
Gleason #2 Surface Hardener

GRINDERS—Miscellaneous

Brown & Sharpe #5 cyl., 3"x18", Black Diamond
Brown & Sharpe #1, #3 Univ., #13 Univ. & Tool
Cincinnati #2 Centerless Filmatic
Cincinnati Universal Filmatic, 12"x36", 12"x48"
Covel #9IA Uiv. Tool & Cutter
Gardner #220, 30" disc. Heald #1 Tool
K. O. Lee Tool & Cutter, Hammond #4 Carbide
Landis #4H Cyl. 4x12", #6 Thread, Landis Centerless
Norton #2 Tool & Cutter. Porter Cable Belt WG8
Norton Cyl. 6x30" Type C
Oliver #510 Drill Pointer, Sellers #4G
Pratt & Whitney Radius #R6, Grenby Int.

GRINDERS—Surface

Abrasive #1½" Wet, #34 Vertical, #33
Atlantic 6x18" Power Feed, Foote-Burt Hammond
Blanchard #18—42" chuck, #11
Brown & Sharpe #2
G. & L. #25, #35 Hyd.
Hanchett #300, 13x48", Mattison 14x16x48 Hyd.
Norton 6x18" Hyd., Pratt & Whitney 12x36" Vert.
Reid #2A P.F., #2C Pope & Excello Spdl.
Thompson Hyd. 6x10x18", 6x12x18

LATHES

Bradford 16"x6', Hardinge Precision 9", cabinet
Hendey G. H. 16x30 with relieving att.
LeBlond Regal 10"x5', 15x30", 19x48", 21x60"
Lodge & Shipley 16x78" T.A., LeBlond HD 18x33"
Monarch 10"x20" EE, 16x78" T.A., 12x30" CKK
Rivett Precision, Logan 10"x30"
South Bend 9"x3', 9"x3½', 13x36", 10" Cabinet
Sebastian 12"x4', G.H., Sheldon 11x24, 1" collet

LATHES—Turret

Acme #6W Bar and Chuck, 6W Fox Lathe
Bardons & Oliver #3, #5, Foster #3B
Brown & Sharpe #1, #2F Hand Screw Mach.
Gisholt #4, 5 Bar & Chuck 2L
Jones & Lamson #8A Univ., Hardinge ESM
Oster #601 Rapiduction, Morey #3, 1½" cap.
Warner & Swasey #3, #4, #5, #4A—8" Bar Cap.

MILLS—Plain & Universal

Brown & Sharpe #2B Pl., #2A Univ.
Cincinnati #3 Plain, 2MH Univ.
Milwaukee #2HL, 2H, Plain, #2HL, 2H, Univ.
Van Norman #12, 20, 22L, 36, Kempsmith 2G

MILLS—Vertical—JIG BORERS

Brown & Sharpe #2, Index, Vernon, Bridgeport
Cincinnati #4, Jackson
Gorton #8D, 9J Plain, #8½D Duplicator
Kearney & Trecker #5M, 3M High Speed
P&W 1½B Jig Borer, Sip Jig Borer #MP-5
Moore Jig Grinder, Vernon jig borer
Morey #12M Profiler 2 sp.—Pratt & Whitney 12B

MILLS—Production

Brown & Sharpe #000, 12, 21
Cincinnati #1-12, 1-18, 2-18 Mfg.
Nichols Hand, U.S. MM 1, Kent Owens #1V
Sundstrand #00 Rigidmills, U. S. Duplex

PRESSES

Bliss #8 Dbl. Crank, Bed 42x100", 250 Ton
Bliss #675, 645B, 650 Hi-Production, 304A, 305A S.S.
Bliss #20, 21 O.B.I., #4½ Double Action Cam
Bliss #58 OB, Gap Frame #62, 62A, 162
Henry & Wright 25, 75 Ton Dieing
Reliance 45 ton O.B.I.
Thomas 7A, 80 Ton O.B.I., Gen. Flex Elec. Screw
V. & O. #25B O.B.I., #102 Reducing, #6 O.B.I.
Zeh and Hanneman 30 tons, #7 Percussion

MISCELLANEOUS

BAND SAW: DoAll #ML, Tannewitz #36M
BENDING ROLL: Buffalo #0, Excelsior #14
BROACH: 3L LaPointe Horiz. Hydr.
HACKSAW: Marvel #6A Automatic, #6, #4B
HONER: Micromatic #H-1 Hydrohoner, Sunnen
IRONWORKER: Buffalo 25U x 20 Univ.
KEYSEATER: Mitts & Merrill, Baker, Davis, Burr
PRESS BRAKE: #335 Chicago
RIVET HAMMERS: HI Speed, all sizes, Chic. Pneu.
ROUTER: Onsrud #W240, #55 Oliver
SHAPER: 32" G. & E. Universal
TAPPERS: Bakewell #1, Haskins #2C, 3C
THREAD ROLLER: Waterbury-Farrel #30 with Dies
VERTICAL SHAPER: 6" Pratt & Whitney
WELDERS SPOT & SEAM: Sciaky, Taylor Winfield
WRAPPING ROLL: Buffalo #1½

HYDRAULIC EQUIPMENT

Cap.	Manufacturer	Platen Stroke	Opening
500 Ton	Lake Erie	35x36"	36" 68"
600	Bald. S'thw'k	78x39"	22" 30"
500 D.A.	H.P.M.	38x36"	24" 30"
1000	French Oil	53x42"	20" 50"
300	Brand New Watson Stillman Hobbing Press		
375 D.A.	Elmes	84x44"	12" 42"
350	Verson	40x40	36" 72"
50	Dennison	22x20	18 23
150	Southwark	34x30	30 2' to 4'

UP MOVING RAM PRESSES

50 & 100 Ton Stokes Molding Presses & Pumps
300 Ton Dunning & Boschert Molding Press
500, 800 Ton Waterbury-Farrel 3 & 4 Rod Presses
300 Ton Watson Stillman Press, 24x20" Platens
400 & 500 Ton Shaft Straighteners—Self Contained

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LATEST TYPE—*Nearly new*
MACHINE TOOLS

BORING MILLS—Horizontal
CINCINNATI GILBERT 3½" bar, floor type, latest
GIDDINGS & LEWIS #45, 5" Bar Table Type, latest
LUCAS #31, 3" bar, Table Type, "Precision", Latest
NILES-BEMENT-POND 5", 8" bar, Floor type, M.D.
UNIVERSAL, 5" bar, high speed, latest type
BORING MILLS—Vertical
BULLARD 8" 8 Spin. Mult-Au-Matic, Type J, latest
BULLARD 12" 6 Spin. Mult-Au-Matic, Type D, latest
BULLARD 16" 6 Spin. Mult-Au-Matic, Type D, latest
BULLARD 24", 36", 42" "Spiral Drive," Latest Type
COLBURN 72", 2 Swivel Heads, PRT, Motor Drive
NILES 108", 2 swivel heads, PRT, D.C., Motor Dr.
DRILLS—Miscellaneous
AMERICAN 1" arm, 11" col., "Hole Wizard", Latest
CINCINNATI BICKFORD 24" Box Col., Latest
LELAND & GIFFORD #2 LMS 6 spindle, Latest
NATCO 4 AL 30 spindle, Multiple, Latest Type
PRATT & WHITNEY 1½"x36" Deep Hole, Latest
GEAR CUTTING EQUIPMENT
FELLOWS #61, #7, #7A, #72, #75, #77, #Z, #61A, #6Z2, High Speed Gear Shapers, latest type
GLEASON 3", 12" straight bevel generator, Latest
GLEASON 12" Bevel Gear Planer, Motor Drive
GOULD & EBERHARDT 12H, 12HS Hobber, Latest
GOULD & EBERHARDT 36H, Hobber, with diff., m.d.
GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #13, Univ. Cutter & Tool, Latest
BROWN & SHARPE #1, 2, 3, 4, Universal, Latest
LANDIS 4412, Type H Plain Hyd., Latest Type
NORTON 6x18" 10x72" 14x36" Type C, Plain, latest
NORTON 6"x10", 10"x20", type C, PL Hyd., latest
GRINDERS—Miscellaneous
BARBER COLMAN #3, 4 tob sharpener, latest type
BRYANT #16-CP-16, #24 Int. Hyd., latest type
CINCINNATI #2 Centerless "Planetic," latest type
HEALD 72A3, 72A5 "Gagematic," Internal, Latest
HEALD 75A, 72A3, 72A5, 74, 76A Internal, latest
LANDIS #12 Centerless Hydraulic, Latest Type
GRINDERS—Surface
BLANCHARD #11, 16" chuck Latest Type
HANCHETT Series 300, 12"x18" Vert. Sp. Hz. Latest
HEALD 24A—Rotary—16" and 36" chuck, hyd. latest
THOMPSON 12x12x24 Type B Hyd., Latest Type
LATHES—Engine & Mfg.
AMERICAN 36"x96" centers, 2 carriages, motor dr.
LEHMANN 16x30" centers, TIMKEN, latest type
MONARCH 16"x30" centers, Model EE Timken, latest
MONARCH 12"x30" Centers, 12"x17" Centers, Model CK, Timken Bearing, Latest Type
MONARCH 22"x156" centers, 3 carriage, Timken Bearing, Model CM, motor drive
NILES 20"x96" Boring, "Time Saver" Timken, Latest
PRATT & WHITNEY 14"x14" Centers, 16"x16" Centers, Model C, Timken Bearing, Latest Type
SPRINGFIELD 12"x30" centers, Timken, latest type
LATHES—Turret
BARDONS & OLIVER #5, #7, Timken, Latest Type
FOSTER #1FT, Fastermatic, Timken, Latest Type
GISHOLT #1L, #2L, #3L, Universal, Timken, Latest
G'SHOLT #1, #1 Univ. TIMKEN, Latest Type
JONES & LAMSON #2, #5 Univ., Timken, Latest
MOREY No. 2G, No. 3, No. 4, Timken Bearing, latest
WARNER & SWASEY #2, Rate Timken, latest
WARNER & SWASEY #2A Universal, Latest Type
WARNER & SWASEY 3A Universal, Timken, Bar and Chucking, New 1947
MILLING MACHINES—Plain
BROWN & SHARPE 2H, 4H, Timken, Latest Type
CINCINNATI 98 Auto. Production, latest type
CINCINNATI 1-D, 2-D Hydromatic Singles, latest
KEARNEY & TRECKER 2H, 3H, 4H, Timken, latest
KEARNEY & TRECKER 2H, 3H, 4H, Timken, latest
MILLING MACHINES—Thread
LEES BRADNER 12"x24", Model HT, Latest Type
MOREY 12x30" and 40" centers, Latest Type
PRATT & WHITNEY 14x60", Model C, Latest Type
MILLING MACHINES—Universal
BROWN & SHARPE 2A, 3A, Timken, Latest Type
KEARNEY & TRECKER 2H, Timken, Latest Type
VAN NORMAN #2K, #3K, Timken, Latest
MILLING MACHINES—Vertical
BROWN & SHARPE #2H Tracer, High Speed
CINCINNATI #2, Dial Type, Timken, latest type
GORTON #8(5), #9, Auto. wood, latest type
KEARNEY & TRECKER #3H, Timken, latest type
PLANERS
BETTS (CONSOLIDATED) 108"x81"x36", 4 heads, Rapid Traverse, Box Table, D.C. motor drive
BETTS (CONSOLIDATED) 120"x96"x36", 4 heads, Rapid Traverse, Box Table, D.C. motor drive
NILES "Time Saver" 72"x42"x14", 3 heads, Rapid Traverse, A.C. variable voltage drive, Latest
NILES "Time Saver" 84"x36"x12", 3 heads, Rapid Traverse, D.C. reversing motor drive
NILES 108"x84"x42", 4 heads, Power Rapid Traverse, Box Table, D.C. reversing motor drive
NILES 72"x72"x30", 4 heads, Rapid Traverse, Box Table, VARI-VOLTAGE DRIVE
SCREW MACHINES—Automatic
CONOMATIC 2¾"—6 spindle, High Speed, Latest
GOSS & DeLEEUW 6" auto. Chucker 5 spin, Latest
GOSS & DeLEEUW 8"x9½" Auto. Chucker, Latest
MISCELLANFOUS
BARNES #17, 20H, 24T, 30TR Vertical Hone, Hydraulic Self Oiling, Latest Type
CINCINNATI 1-36, 2-36, Duplex Vert. Surface Broach, Double ram, Model FR Hyd. Latest Type
HENRY & WRIGHT 50 ton Dieing Press, M.D.
KEARNEY & TRECKER Model B Automatic Jig Borer, Latest Type
MICHIGAN 1708, 1712 Universal Roller, Latest
PRATT & WHITNEY (KELLER) Type BL-2416 & Type G Copying, latest type, 2 & 3 Dimensional

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LATE TYPE MACHINE TOOLS

AUTOMATICS
6" RPA-8 Acme-Gridley Chucker. 1941.
16" Bullard Mult-Au-Matic, 6 spdl. '41.
1⅝" Greenlee, 6 spindle. 1942.
⅝" RA-6 Acme-Gridley. 1942.
No. 60 New Britain, 1" cap. 1943.

BORING MACHINES
No. 42 Lucas Horizontal. 1940.
No. 54 Excello Double End. 1940.
No. 46B Heald Single End. 1940.

DRILLS
3'8" Morris "Mor-Speed," Latest.
25" Fosdick "Economax". 1941.
W-6 Baush Hyd. Mult. Spdl. 1943.
No. 40 Fox Multiple Spdl. 1944.

GEAR EQUIPMENT
3" & 12" Gleason Generators. 1941.
No. 6 & 17 Gleason Testers. 1943.
12" Red Ring Internal Shaver. Late.
No. GCL-3 Red Ring Shaver. 1942.
No. 624A3 Fellows Side Trimmer. New.
No. 615A & 61A Fellows Shapers. 1943.
No. 7125A & 712 Fellows Shaper. 1943.
Vinco Spline & Gear Grinder. 1942.

GRINDERS, CYLINDRICAL
16"x36" Cincinnati Plain. 1942.
12"x48" Cincinnati Univ. 1943.
10"x72" Landis Plain. 1942.
10"x18" Norton Plain. 1942.

GRINDERS, INTERNAL
No. 74 Heald Ext. Bridge. 1941.
No. 72A3 & A5 Heald Plain. 1944.
No. 5 & 16A22 Bryant. Latest.

GRINDERS, SURFACE
14"x36" P&W Vertical. 1938.
No. 22 & 25A Heald Rotary. 1943.
No. 2—1 Reid, 6"x18" cap. 1940.

LATHES, ENGINE
45"x192" Axelson. 1942.
28"x276" Bertram. 1942.
24"x168" Sidney. 1942.
18"x54" Lodge & Shipley. 1943.
18"x48" Bradford. 1942.

LATHES, PRODUCTION
Gisholt "Simplimatic". 1943.
No. 3A L&S "Duomatic". 1943.
No. 2FU Foster "Fastermatic". 1943.
20"x97¼" LeBlond Rapid Prod. 1941.
8"x109" Lo-Swing Semi. Auto. 1942.
Model 8, 10 & 12 Sundstrand. 1942.
14"x42" Monarch "Magna-Matic". 1941.

LATHES, TURRET
36" Bullard Vertical. 1943.
No. 2A & 3A Warner & Swasey. 1943.
No. 1 & 8½"x24" Acme Univ. 1943.
No. 3L Gisholt. 1941.
No. 2, 3, 4 & 5 Warner & Swasey. 1943.
No. 2, 3, 5 & 7 Bardons & Oliver. 1942.

MILLS, PLAIN
No. 5 Cincinnati. 1943.
No. 4H & 4K Milwaukee. 1943.
No. 3 Van Norman. 1942.
No. 2HL Milwaukee. 1942.

MILLS, PRODUCTION
BL-2420 P&W "Keller", 3 sp. 1942.
BL-2416 P&W "Keller", 1 sp. 1943.
BG-1 Keller, single spdl.
No. 1848 Kearney & Trecker. 1942.
No. 1249 Kearney & Trecker. 1942.
No. 1-1B & 2-1B Cincinnati. 1942.

MILLS, THREAD
6"x60" Pratt & Whitney. Latest.
12"x54" Lees Bradner. 1943.
8"x16" Hanson Whitney. Late.

MILLS, UNIVERSAL
No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No. 2SU & 26SU Van Norman. 1942.

MILLS, VERTICAL
No. 3B P&W Univ. Die Sinker. 1943.
No. 3H & 3K Milwaukee. 1942.
No. 2 & 3 Cincinnati. 1941.
No. 2K Milwaukee. 1942.

PRESSES
No. 40-51½ Minster. 1946.
100 Ton Hannifin, Hyd. 1942.
75 ton Bliss Hydraulic—60" stroke. Latest.
45 Ton Reliance. 1942.

INDIANAPOLIS MACHINERY & SUPPLY CO.
1961 S. Meridian St.
INDIANAPOLIS 6, IND.

CUT YOUR PRODUCTION COSTS! SAVE MONEY HERE!

LATHES

Bridgeford 36"x56' 15-speed Gr. Hd.—38" Act. Swing—48' C. Dist.—Mtsd. carriage

Putnam Heavy Duty 36"x20'6" Triple Bk. Gr. —Qck. Change Gr.—Box type—low bed—center leg—37" act. swing—13' C. Dist.

Bridgeford 36"x14' 9-speed Gr. Hd.—38½" Act. Swing—84" C. Dist.

VERT. MILLERS (Late)

Reed-Prentice #4 Improved Hydraulic—wkg. surf. tbl. 70x24"—18-speeds—30 to 1200—1945 mch.

Brown & Sharpe #2 Lite Type—wkg. surf. tbl. 45"x10"—33 to 1800-RPM—range 28x10x 14"

Milw. (K&T) #2K and #3K Hi-Speed
Cinn. #1M and #2M Pyramid Column motor-in-base

GRINDERS

Mattison 24"x18"x96" Hyd. Hi-Power Precision Surface — generator set — chuck — coolant—(excellent condition)

Farrel 30"x182" M.D. Roll Grinder—30" max., 9" min. roll ground

Excello #35 Univ. Type Thread—8" dia. x 22" length—1942—(excellent condition)

Norton 10"x18" Type-C Mech. and 10"x36" Type-C Hydraulic—(added attchmts)—late

RADIAL DRILLS

Morris 4'9" "Mor-Speed" Hi-Duty motor-on arm—75 to 1500-RPM—#4 Morse Taper—(late)

Fosdick 5'17" motor-on-arm "Economax" Hydraulic—#6 Morse taper—20 to 1400-RPM

NEW—Rafter All Steel Squaring Shear—available in two sizes;
¼"x10' mild Steel
⅛"x10' stainless steel
3 16"x12' mild steel
3 32"x12' stainless steel
Immediate delivery from stock

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SPECIAL OFFERING

#4-R GISHOLT SADDLE TYPE TURRET LATHE, SERIAL NO. 2914-37, 9" HOLE IN SPINDLE, Mfg. approx. 1942.
PRICE **$4,500.00**

#3-R GISHOLT SADDLE TYPE TURRET LATHE, 5" HOLE IN SPINDLE, 1942 MACHINE.
PRICE **$2,500.00**

Both Machines in Excellent Condition

WINSTON MACHINERY CO., INC.
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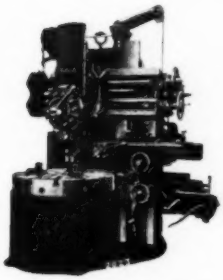

42" Bullard "SPIRAL DRIVE" Vertical Turret Lathe, at left, with extra high column providing 57" under cross rail. Inspect at Albany.

And . . .

54" Bullard "SPIRAL DRIVE", 4-jaw chuck
42" Bullard "SPIRAL DRIVE", 3-jaw chuck
36" Bullard "SPIRAL DRIVE", 4-jaw chuck
36" Bullard "NEW ERA", 3-jaw chuck
24" Bullard "NEW ERA", 4-jaw chuck
36/44" Niles Vertical Turret, Side Head

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Metal Forming and Bending Machine
#206-F Toledo 155 Ton D.C. Press, 3" Stroke, 20" x 110" Bed Area
Roller Type Slab Miller 22" Slab capacity
12 Spindle Moline Automatic Drilling Machine
3 Spindle Moline Model 7-D Cylinder Borer
1-A W&S Universal Turret Lathe
36" x 14' Schumacher & Boye Engine Lathe
Libby 26" x 4½" Spindle Turret Lathe
26" Stockbridge Shaper
Lees-Bradner CT 36" Thread Millers
Crankshaft Grinder
Foote-Burt 4 Spindle Drill #2 M.T.
Acme Gridley 4 Sp—Model G—1¼" Auto.

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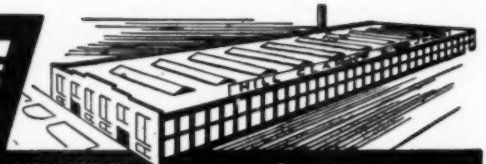

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AUTOMATICS

1⅝" Greenlee, 6 Spdls. (1941)
No. 61 New Britain 6 Spdls. 1⅝" (1942)
No. 6 Brown & Sharpe, M.D.
No. 49 New Britain, 4 Spdl. Chucker
Model A 2½" Cleveland (1943)
Model A 3¾" Cleveland (1942)

DRILLS

No. 150 Baker, tapping (1942)
No. D8 Colburn, No. 6 Morse Taper
No. 2 Fosdick 4 Spdl. (1942)
No. 2 Fosdick 6 Spdl. (1942)
No. 1-LMS Leland-Gifford (1942)
No. 2-LMS Leland-Gifford (1942)
No. 4BL Natco 36 Spdl. (1943)
5' Western Heavy (1942)
6'-17" Col. Fosdick Economax Radial

GEAR MACHINES

No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 18H Gould & Eberhardt
72" Cincinnati Gear Cutter

BORING MACHINES

3" Bar Universal Tri-way (1946)
No. 31 Lucas, 3" bar, M.D.
No. 46-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
42" Colburn, M.D.
60" Colburn, M.D.
72" Niles Extra Heavy
84" Betts, M.D.

GRINDERS

3"x12" Brown & Sharpe No. 3 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
Norton Motorized Grinders ranging from 6"x18" to 24"x240"
No. 5—8"x24" Covel Hydr. Surf. (1941)
72A-3 Heald Internal Grinder (1942)
72A-5 Heald Internal Grinder (1942)
74 Heald Internal Gdr. (1942)
Bryant Internal Grinders (1942)

LATHES

14"x30" centers Pratt & Whitney, Model C
14"x30" centers Monarch
16"x54" centers LeBlond (1941)
16"x60" centers Pratt & Whitney, Model B
18"x6' American, Gdr. Head, M.D.
19"—38" gap x 10' LeBlond
36"—48"x16' Lehman Hydratrol (1945)
8"x15" Sundstrand, Model D (1943)
10" Sundstrands (1942, 1943)
16" & 20" Fay Automatics (1942)
No. 2 Warner & Swasey, Bar Feed (1942)
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4B Libby, Bar Feed (1942)
No. H-5 Libby
No. 5 Bardons & Oliver (1942)
No. 5 Midland, Bar Feed (1942)
No. 2-A Warner & Swasey
No. 1-H Libby, 6¼" Hole in Spindle (1937)
No. 1-H Libby, Extra Long Bed (1942)
18" Libby, 3½" Hole in Spindle
No. 4A Warner & Swasey, 7½" Hole in Spindle

MILLING MACHINES

No. 2 SP Van Norman Plain (1942)
No. 2H Milwaukee Plain (1942)
No. 2 H Milwaukee Vertical (1942)
No. 2 Cincinnati Vert. (1942)
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cin. Mig. (1940)
No. 2—18 Cincinnati, Rise & Fall (1941)
No. 2—18" Sundstrand-Electromil (1942)
38"x40"x18' Fitchburg Duplex Miller (1943)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex
No. 45-48 Cinn. Hyd. Duplex
No. 36-72 Cincinnati Hydromatic
4½"x12" Pratt & Whitney, Model C Thread Mill
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1942)
24"x24"x12' Ingersoll Adj. Rail Slab Miller
36"x36"x18' Ingersoll Slab Miller, 4 Hds.
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A Pittsburgh power-driven brush performing a washing operation in the Steel Mill at Crown Cork & Seal Company, Inc., Baltimore, Maryland.

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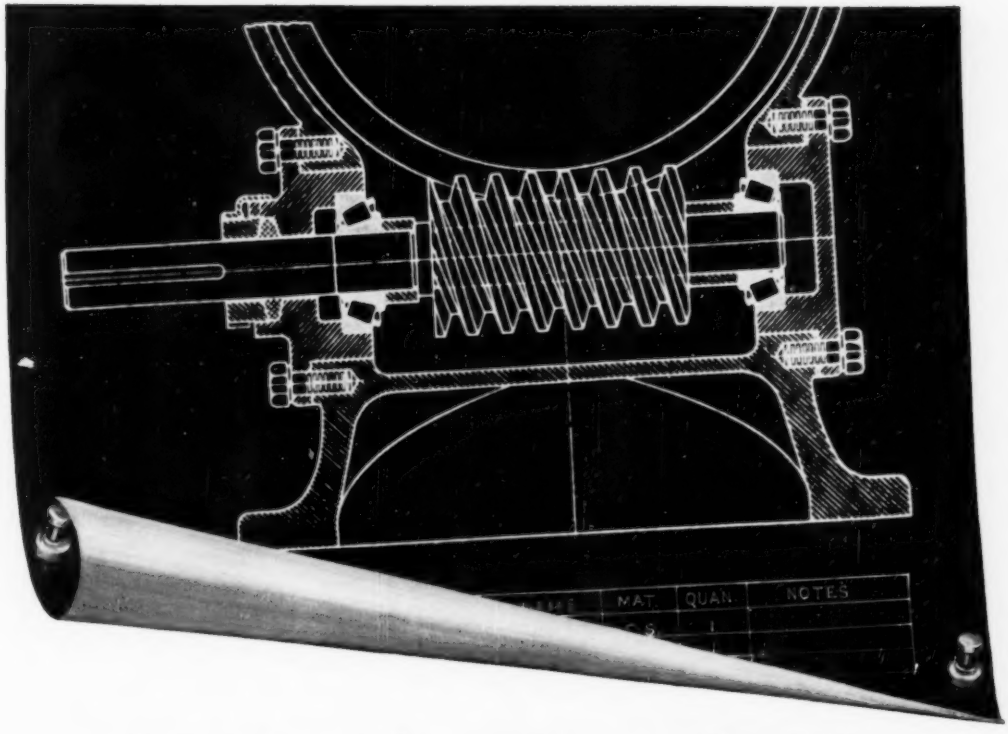

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